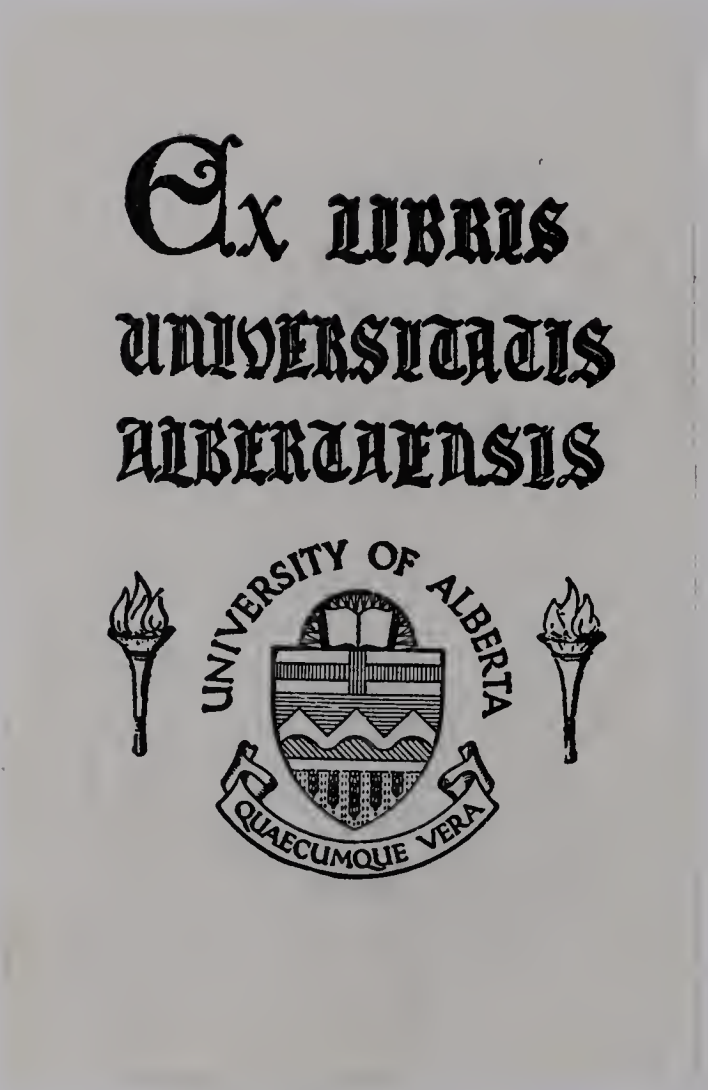

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RELATIONSHIP OF GSR, HEART-RATE AND PERSONALITY TRAITS TO INFORMATION INTAKE

by

JOHN DIETRICH FRIESEN

A THESIS

SUBMITTED TO THE FACULTY OF GRADUATE STUDIES

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FACULTY OF GRADUATE STUDIES

The undersigned certify that they have read, and recommend to the Faculty of Graduate Studies for acceptance, a thesis entitled "Relationship of GSR, Heart-Rate and Personality Traits to Information Intake."

Date: September 1965.

ABSTRACT

This study was designed to investigate the relationship of GSR, heart-rate and personality traits to the efficiency of information intake. From hypotheses advanced by Lacey, it was predicted that during the subjects' attention to specific environmental stimuli, heart rate would decrease and GSR would increase. From further studies advanced by a group of researchers headed by Silverman, Gardner and Witkin, it was predicted that a significant relationship existed between personality traits and the efficiency of information intake. Efficiency of information intake measures were based upon the theoretical framework developed by Gibson.

The sample consisted of 71 male university students whose mean age was 25 years 8 months and who had an age range from 19 years, 5 months to 42 years, 3 months.

The measures of GSR and heart rate were recorded in response to the stimulation provided by Gibson's "feelee tasks." The personality tests used were the Cattell Sixteen Personality Factor Questionnaire and the Guilford-Zimmerman Temperament Survey. Measures of information intake included accuracy scores and measures of total time required to verbalize a decision.

Statistical analyses were carried out using the Product-Moment Correlation, Applied Multiple Linear Regression Analysis and Factor Analysis.

The major findings of the study were as follows:

1. Cardiac deceleration did not occur during information intake.
2. Efficiency of information intake as measured by accuracy was significantly related to the factors, intelligence, restraint, extraversion and heart rate.
3. Efficiency of information intake as measured by total time required to verbalize a decision was significantly related to paranoid schizothymia and ascendance.
4. The personality traits associated significantly with GSR were extraversion and restraint.
5. The personality traits associated significantly with heart rate were surgency and extraversion.

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CHAPTER I

INTRODUCTION

A suggestive and reasonable hypothesis in the light of recent research is that efficiency of information intake, personality traits and physiological responsiveness to stimulation are related. (Silverman, 1964; Pettifor, 1964; Menninger, 1963, Gardner, 1961; Ittelson and Kutash 1961; Wechowicz and Blewett, 1959). The present study is a further investigation of some of the suggested personality and physiological correlates of efficiency of information intake.

Three main lines of psychological study have given guidance to the development of this thesis. These include (a) Gibson's Theory of Perception, (b) Lacey's Theory of Directional Fractionation of Response, (c) and research relating to personality characteristics, perception and diagnostic categories. A brief discussion of each area will be presented below.

Gibson's Theory of Perception

Gibson has developed a theory of perception which has three major parts. These may be summarized as follows:

1. A psychophysical theory of perception. This suggests that perception is specific to stimulation thus dispensing with any intervening special process.
2. A biophysical theory of the nature of stimulation. This attempts to trace the chain of specificity between the proximal energy at receptors and objects

of the external environment.

3. A discriminational theory of the development of perception. This suggests that improvement in perceiving is a matter of discovering the invariant properties of stimulation.

The basic logic of Gibson's theory is simple. There are dependent variables of perception and independent variables of stimulation. No intervening variables are presumed. The mathematical properties of the flowing array of stimulus energies specify all the known properties of the phenomenal world of the observer. Perception is the process by which an individual maintains contact with his environment. Stimulation means the kinds and variables of physical energy in the environment to which the sense organs of the individual will respond.

The Information Value of Stimulation

Gibson's theory of perception is concerned with the organism's capacity to keep in contact with the array of stimulation in the environment. Environmental stimulation specifies things about objects, places, events, animals, people and the actions of people. Potentially all stimuli contain information but whether they will become effective depends upon the individual. It depends on the species to which he belongs, on the anatomy of the sense organs, the stage of maturation, the capacity for sense organ adjustment, the habits of attention, the activity in progress and the possibilities of educating the attention of the individual. According to Gibson, such facts make up the field of perceptual

development and perceptual learning. At the lower levels, they are called the facts of sensory physiology; at the higher levels, facts of attention or exploration.

Gibson (1959) provides a positive hypothesis regarding the stimulus when he states:

> In describing the stimulus, we might search for an invariant component in the bewildering variety of functionally equivalent stimuli. Many sorts of higher order variables may exist, only waiting mathematical description. They will have to be described in appropriate terms, of course, not as simple functions of frequency and amount. We must not confuse a stimulus with the elements used for its analysis. We must learn to conceive an array, not as a mosaic of stimuli but as a hierarchy of forms within and a flux not as a chain of stimuli but as a hierarchy of sequences within longer sequences. (p. 700)

Exploratory and Performatory Behavior

Gibson proposes the existence of two types of behavior, namely exploratory and performatory behavior. Exploratory behavior has to do with the discovery of stimulus invariants in the environment. Performatory behavior is concerned with modifying or changing the environment. The motor system and muscular activity is involved in both kinds of behavior. Some muscles like the eye muscles primarily enhance the exploratory system. Other muscles like the muscles of the leg are concerned largely with performatory behavior.

Feedback Loops for Exploring Stimulation and Controlling Behavior

Figure I illustrates two types of feedback loops used in exploring stimulation and controlling behavior. It shows on the left, the modification of stimulation by reactions of the exteroceptive sense

organs and on the right the modification of reactions by stimulation of the proprioceptive sense organs.

The Role of Attention in Perception

Gibson's theory of perception emphasizes the role of the sense organs. He states (1961):

> An entirely different picture of the senses emerged. For this to happen, we had to suppose that their sole function was not to yield sensations. Instead of mere receptors, that is receivers and transducers of energy, they appear to be systems for exploring, searching and selecting ambient energy. (p. 12)

The selecting of ambient energy is thus the function of the sense organs. Sense organs do not create stimulation, but rather select the invariant properties of stimulation. Such selection is achieved through the attentive adjustment of the sense organs and by the education of the attentional system or in Gibson's terms "the education of the esthesic system." Gibson prefers the term esthesic system because it implies the adjustment of the sense organs to stimulation. The esthesic system and the attentional system are synonomous terms in Gibson's theory of perception.

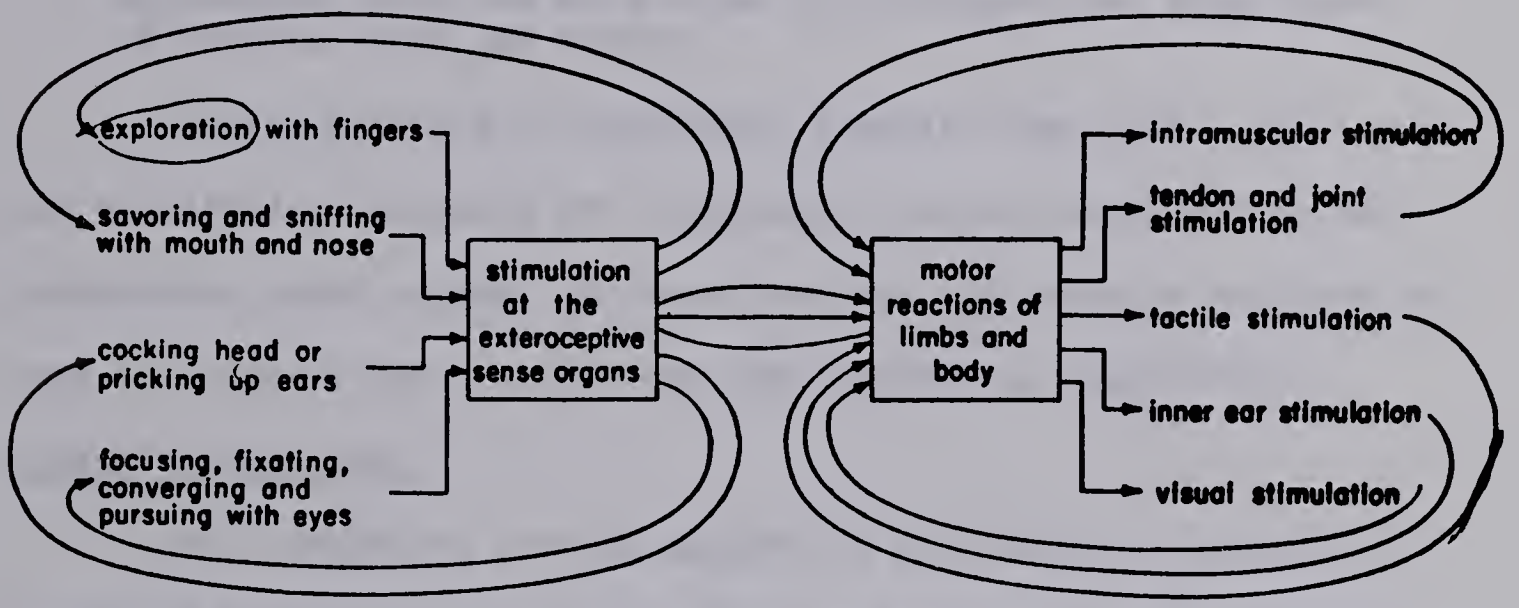
Passivity and Activity in Touch and Vision

In passive touch the individual makes no voluntary movements. Similarily, in passive vision he makes no eye movements but voluntarily fixates his eyes on a specified object. Neither state is natural to the individual. In a situation where tactual stimulation is available, the individual will normally explore with his fingers unless prevented and

FIGURE I

THE ROLE OF ATTENTION AND EXPLORATORY

ACTIVITY IN PERCEPTION



The feedback loops for exploring stimulation and those for controlling behaviour. The angular lines represent physical action; the curved lines represent neural action.

Gibson 1962, p. 485

in a visual situation he will explore the focussable light, fixating, accommodating and converging.

Gibson describes the effects of active touch and vision as follows: (1962, p. 489)

> In active touch and vision the individual reports experiences of a quite different order than in passive touch and vision. In active touch and vision the experiences correspond to the environment. The experiences noted with passive stimulation can scarcely be noted if at all. The effective stimuli are presumably different, being relations and combinations, selected from a flux of potential stimuli. Moreover, the experiences of active touching and looking are more nearly equivalent; they are more alike to introspection, than those of passive touch and vision.

Gibson's theory of perception suggests that vision and touch are conceived as channels for information intake having active and exploratory sense organs. In some respects they seem to register the same information and to yield the same phenomenal experiences.

Gibson's Experiment

As a method of testing aspects of his theory, Gibson has developed a discrimination task which was employed in this thesis. In Gibson's experiment, subjects were requested to discriminate between patterns of shape that had no ulterior meaning like that of letters, digits, diagrams or pictures. The task required a careful visual and tactile exploration of the objects since there was considerable repetition of pattern from object to object.

Gibson in his experimental work has shown that one of the reasons for the variability among subjects in correctly discriminating the

perceptual tasks was due to the active or passive state of the sensory receptors. Correctly discriminating between the patterns and shapes required information intake from two sensory channels, vision and touch.

In the next section of this chapter, Lacy's theory of directional fractionation will be reviewed. Whereas Gibson's theory of perception provides empirical evidence in support of the hypothesis that active and passive touch and vision influences shape and pattern discrimination, Lacy's theory provides a neurophysiological index of information intake.

Lacy's Theory of Directional Fractionation

Lacy and associates (Lacy, 1962; Obrist, 1963; Calloway, 1964) proposed the hypothesis that cardiac deceleration accompanies and perhaps even facilitates ease of information intake whereas cardiac acceleration accompanies or facilitates a rejection of information.

As a support of the "acceptance-rejection" hypothesis, Lacy pointed to psychophysiological evidence that pleasant stimuli (those that the organism wants to take in from the environment) produce cardiac deceleration whereas unpleasant stimuli (those that the organism wants to reject) produce cardiac acceleration. As further evidence, Lacy reviewed the fragmentary neurophysiological research which seemed to show that cardiac deceleration activated the ascending reticular activating system and alerted the cortex. Cardiac acceleration seemed to suppress the ascending reticular activating system and inhibit

cortical arousal. (Lacy, 1958; 1959; Obrist, 1963; Dell, 1958) A suppression of the ascending reticular activating system and inhibited cortical arousal might tend to minimize information intake.

Lacy's Experiment on Directional Fractionation of Response

In a recently reported study, (Lacy, et al., 1962) Lacy and associates tried to clarify the differential stimulus conditions which determine whether cardiac acceleration or deceleration occurs. Two totally different populations in a variety of stimulus situations were used. One sample consisted of a large group (N-94) of male college freshmen unacquainted with research procedures. The other sample consisted of 30 adult males who were subjects in the longitudinal study of human development carried on by Fels Research Institute. The stimulus situations used to obtain physiological responses were the following:

(1) A Mental Arithmetic Test. The subjects were required to solve simple multiplication and addition problems.

(2) A reverse Spelling Test. Words were spelled aloud in reverse order and the subject had to mentally rearrange the letters and announce the correct word.

(3) Make-Up Sentences Task. The subject had to think up meaningful sentences of at least five words, each of good grammatical construction.

(4) Flashes at 10 cycles per second by a Gross Photo-stimulator under instructions to note and detect the

varying colors and patterns so produced.

(5) Drama. The subject was under instructions only to listen carefully and to empathize with the affect presented in on effective and moving tape-recorded recitation.

(6) Rules of the Game. The subject had to listen to an tape recording of a set of rules for a fictitious card game.

(7) White Noise. The instructions to the subject were to note and detect the environmental input. The noise was definitely unpleasant and fluctuated irregularily in loudness reaching peak intensities in excess of 100 dbs. above threshold.

(8) Cold Pressor Test. Subjects were presented with the Cold Pressor Test and their physiological reactions observed.

The stimulus conditions which produced cardiac deceleration were Rules of the Game, Drama, White Noise and Flash. These stimuli have in common the fact that the subjects were instructed to note and detect the incoming stimuli throughout the period of stimulation. The tasks differed in the modality used; two used auditory and two visual senses. They also differed in the degree of emotional participation and semantic and symbolic complexity.

The stimulus situations which produced cardiac acceleration were Sentences, Mental Arithmetic and Reverse Spelling. These have in common the element of "mental" work and concentration. They differ among themselves in the novelty and routiness of the task, in whether they deal with symbols and whether or not they require adherence to long-established and familiar rules.

If we accept the notion that "mental concentration" is facilitated by ignoring external stimuli and eliminating distractions, then it becomes easier to accept an information intake continuum. One end of the continuum provides for an acceptance of information and the other end provides for the rejection of environmental information. The rejection end of the continuum characteristically corresponds to high heart rate whereas the acceptance end corresponds to low heart rate. High heart rate may be interpreted as facilitative of mental concentration as required during cognitive elaboration involving storage, retrieval and recombination of information.

Two stimulus situations were designed by Lacy which involved both an "acceptance" and "rejection" of external environment. They were Rules of the Game and Noise. In Rules of the Game the subjects had to listen to a tape recording of a set of rules for a fictitious card game. These rules had to be stored in the memory and held in some sensible form because the subjects knew they would be questioned closely about the rules of the game. Throughout, the subject had to not only pay close attention to incoming stimuli but also resort to internal

activities of storage and recombination of information.

The results of the experiment indicated that heart rate during the rules of the game lies somewhere between environmental rejection situations and environmental acceptance situations. For the large group of male college freshmen there was no change of average heart rate from the alert to the stimulus period. For the other group there was a deceleration, but this deceleration was not as great as in the environmental intake situations. The data supports the hypothesis that a situation simultaneously requiring attention to environmental input and internal cognitive work has a balancing effect on heart rate.

In the White Noise experiment however, an intermediate effect on cardiac rate was not obtained. The instructions were to attend which should have produced cardiac acceleration, but since the stimulus was unpleasant a cardiac acceleration could be expected. The results showed a marked cardiac deceleration. This phenomena might be explained however in terms of the prepotency of the stimulus situation. The directive to attend may have been a more potent stimulus than the noise.

Other Experimental Work Supportive of Lacy's Theory

Other earlier investigators have noted cardiovascular changes which in part are consistent with Lacy's results. Darrow (1932, p. 267) in a review of earlier literature concerning the effects of various types of sensory stimuli on cardiovascular activity states that stimuli requiring close attention to the environment frequently

decelerate the heart rate. Darrow (1929, p. 185) reported that ideational stimuli (free associations to words) caused greater increases of blood pressure than various types of sensory stimuli. GSR reactivity was however greater to sensory stimuli than to ideational stimuli.

Davis and Buchwald (1957, p. 78) report a study in which heart rate decelerated in response to a variety of pictorial stimuli including pictures of nudes.

Obrist (1963, p. 450) replicated previous demonstrations that sensory stimuli involving continuous environmental input decelerate heart rate even in the presence of increased sympathetic tonus as measured by skin resistance. Obrist's experiments using noxious stimuli and a conceptual task involving the solution of arithmetic problems resulted in heart rate acceleration, increased systolic blood pressure, peripheral vasconstriction and increased skin resistance. On the other hand stimuli to which the subject paid very close attention tended to produce cardiac deceleration, decreased systolic blood pressure, peripheral vasodialation and variation in skin resistance.

Callaway and Thompson (1953, p. 443) cited experimental evidence that perceptual accuracy and speed can be influenced by the experimental manipulation of heart rate. In size constancy experiments, size judgements always became less accurate with experimentally induced heart rate increase. The chemical used to induce heart-rate increase was amyl nitrite.

In a more recent study, Callaway and Dembo (1958, p. 74)

reported that heart-rate acceleration initiated by atrophine or metha-amphetamine produced poorer performance on tasks requiring close attention to environmental input. For example, in size constancy experiments, their subjects tended to misjudge distances. After unsuccessfully attempting to relate the findings to local opthalmic changes. Callaway and Dembo considered a decreased attentiveness to peripheral distant cues as the most likely cause of the increased inaccuracy.

Research relating to Personality Traits, Perception and Diagnostic Categories

Silverman (1964) in a recent article has developed the notion that the cognitive control principles, scanning and articulation, may be useful diagnostic categories in differentiating subgroups within schizophrenia. Although this study is not directly concerned with the problems of schizophrenia, the reported findings are suggestive of possible relationships between personality traits, ways of perceiving and information intake among relatively "normal" individuals.

A study of "normal" adults has shown that wide variations in attention to the external environment occur. Certain adults tend to be guided by external stimulation whereas others tend to give greater attention to inner stimuli, memories and images. Certain people have an underlying preference for making fine discriminations whereas others tend to make global differentiations.

Various tests have been used to demonstrate perceptual

differences among subjects. Some of these include: (a) the rod and frame test in which separations of objects from their surroundings are made; (b) the tilting-room-tilting-chair task which measures the differentiation of field cues from sensory cues; (c) the embedded figures task which requires a perceptual restructuring of the stimulus field; (d) the color-word test or the Muller-Lyer illusion which measure the perceptual inhibition of distracting intrusive cues.

A research team headed by Gardner (Gardner, et al., 1959) published a monograph entitled "Cognitive Controls" in which they reported a factor analysis of performance on 33 perceptual tests yielding six factors for women and five for men. A year later a second monograph (Gardner, et al., 1960) supported the earlier one. The factors identified will be discussed in the following section.

The Concept of Cognitive Control

The concept of cognitive control has been developed in a series of papers dating back to 1948. Most of these articles have been documented by Gardner,et al (1959) and consequently no attempt will be made to trace the concept to its original source.

Gardner, et al (1959) base their cognitive control studies on the premise that the wide range of adaptive behaviors which an individual manifests may be encompassed by a relatively few dimensions or principles of organization. These dimensions are called "cognitive control principles" and represent what the authors feel are consistent individual differences underlying approaches to perceptual tasks.

Gardner, et al (1959) define cognitive controls as follows:

> Cognitive controls are conceived as slow-changing, developmentally stabilized structures: (a) they are relatively invariant over a given class of situations and intentions; (b) they are operative despite the shifts in situational and behavioral contexts typical of cognitive activity from moment to moment. Cognitive controls refer to a level of organization that is more general than the specific structural components underlying perception, recall and judgement. The invariant which defines a control has to do with the manner of coordination between a class of adaptive intentions and a class of environmental situations. They are the individuals means of programming the properties, relations and constraints of events and objects in such a way as to provide an adaptively adequate resolution of the intentions which brought him into an encounter with reality. (pp. 5-6)

The cognitive control principles determine the ways in which potential information is acted upon by the individual. They are the selective or attentional factors regulating information input and determining what is and what is not to be ignored.

Five cognitive control principles are described in the literature. These include:

(1) Leveling-Sharpening. This pertains to differentiation in memory organization. High scores or levelers showed relatively simple, undifferentiated memory organizations. Low scorers or sharpeners were able to maintain discrete impressions and memories of successive stimuli.

(2) Equivalence Range. This reflects the degree to which an individual judges stimuli to be similar. High scorers were less particular about stimulus differences and group stimuli into broader categorizations. Low scorers showed narrower categorizations and were

more exacting in their criteria of similarity. Fillenbaum (1958) found no significant relationships between his measure of equivalence range and the factors, decision time, absoluteness of judgement, response sensitivity, intellectual ability or MMPI scores.

(3) Tolerance for Unrealistic Experiences. This principle represents modes of organizing behavior in respect to experiences that violate the normal assumptions of reality and are brought into play when a subject is required to judge the degree to which unrealistic events appear real.

The last two cognitive control principles will be dealt with in much greater detail because they have greater relevance to this study. They are the cognitive control principles of scanning and field articulation.

(4) Scanning. The scanning control principle is an attentional strategy or schemata which refers to the extensiveness with which an individual samples the various stimuli of a stimulus field. Persons with high scores scan their environment extensively whereas persons with low scores scan their environment to a limited degree.

Gardner, et al (1959) describe the extensive scanner as follows:

> The extensive scanner actively pursues objects about him and is continuously searching or scanning the field, becoming aware in this process not only of field properties relevant to his present intentions but also of fringe properties. One consequence of extensive scanning of object properties is the stabilization of conceptions of objects. A second consequence of extensive scanning is a slowing of decision making. (p. 89)

Measures of scanning activity most widely used are the tests of

visual constancy and size estimation. High scorers on these tests are more accurate in performance than low scorers. High scorers are able to report more accurately the actual size and shape of objects regardless of differences in slant or distance. In size-estimation tasks, the subject is required to match the variables with the standard. The errors made by subjects on these tasks has been interpreted differently by researchers.

Originally Schlesinger (1954) postulated a focussing control principle which served to keep experiences separate and discrete. Accuracy estimation of size was thought to result from narrowed attention to relevant stimuli. Gardner, et al (1959) and his team of researchers suggest that error on the test may result from minimum scanning. They draw upon Piaget's "centration hypothesis" (Piaget, et al, 1958) for a theoretical explanation. According to this hypothesis the stimuli or stimulus pattern at the center of the attentional field will be over-estimated. Gardner, et al (1959, 1960, 1961) have demonstrated that extensive scanners manifest both minimal under-estimation and minimal over-estimation. Limited scanners evidence large over-estimations of variables.

In relating scanning to personality, Gardner and Long (1962) state that:

> The extensive scanner seems preoccupied with the verdicality, exactness and acceptibility of his response. The limited scanner seems to accept his perceptual experience in a more relaxed and less critical way. (p. 139)

Klein (1958) describes the extensive scanner in the following terms:

> The dominant impression was one of intense intellectualizing tendencies, pervasive experience of ambivalence, mistrust and expectation of being hurt. They regarded the world as a source of malevolence and danger, and had a generally pessimistic outlook on the present and future. They seemed preoccupied with issues of mastery and they were intensely self-absorbed. They felt guilty, dissatisfied with their achievement and their contacts with objects and people were darkened by aggression. At the same time they were intensely absorbed in the rejecting and threatening world of people and things. (pp. 111-112)

By the use of the Rorshach indices, Gardner (1962) found that extensive scanners are likely to rely on the defenses of isolation and projection. They are also more concerned with the symmetry of the blots than are minimal scanners.

The relationship of perceptual constancy (scanning) and Extraversion-Introversion have been studied by several investigators. Thouless (1932) studied the perceptual constancy performances of introverted or "schizothymic" individuals and extraverted or "cyclothymic" individuals. He found that the perceptual performances of schizothymic patients, selected on the basis of Kretchmer's descriptions, tended to be less overconstant (limited scanners) than the performances of cyclothymic individuals. Other findings were greater constancy with increasing age and intelligence. The finding of greater size constancy (extensive scanning) in extraverts than in introverts was confirmed by Weber (1939).

Silverman (1964) in a review of the literature on schizophrenics

and attention draws the following conclusions:

(a) Extensive scanning tends to be associated with the paranoid schizophrenic. Minimal scanning tends to be associated with catatonic, simple and hebephrenic subtypes of schizophrenia.'

(b) A moderate or monextreme scanning pattern in schizophrenia is associated with good prognosis.

(c) The more limited the scanning, the greater the degree of schizophrenic withdrawal.

(d) Experiences that are associated with success result in increased scanning whereas failure tends to result in decreased scanning.

(e) Minimal scanners tend to have greater drops in systolic blood pressure following the injection of mecholyl than do the extensive scanners. This greater drop in systolic blood pressure in minimal scanners according to Ostrow (1962) is indicative of ego depletion.

(f) Avoidance behaviour tends to be associated with minimal scanning and approach behaviour with excessive scanning.

(g) Scanning responses like any other response are directly affected by negative or positive feedback.

(h) Potentially threatening stimuli tend to further reduce the scanning responsiveness of minimal scanners. (i.e. by fixation)

(i) Potentially threatening stimuli tend to increase the scanning activity of extensive scanners, thus underestimating

unpleasant stimuli.

(j) Scanning responsiveness is reduced by highly anxious subjects. They tend to overestimate or fixate.

(k) The intra-individual differences in the scanning activity of schizophrenics is greater than that of anxious normals.

(5) Field-Articulation. In addition to the previously mentioned factors, field-articulation is another cognitive control principle extracted from performance scores on perceptual tests which seem to influence information intake. By definition, field-articulation, is a concept used to explain the tendency of an individual to selectively attend to certain stimulus inputs and simultaneously inhibit attention to other inputs. The concept of field-articulation was elaborated by Gardner, et al (1961) to explain individual differences on tasks of "perceived incongruity" and the tendency of the individual to attend selectively to one cue in the opposing response hierarchy.

Field-articulation is theoretically linked and includes Witkins, et al (1954) concept of field dependence-independence and Klein's (1954) constricted - flexible control principle.

Witkin and his team of researchers (Witkin, et al., 1954, 1959, 1962) have studied a construct they have named psychological differentiation. Witkin, et al (1954) found that very young children tend to perceive in a field-dependent fashion but as they grow older their perception becomes more field independent. From this he

inferred that as the child develops he is better able to attend selectively to relevant stimuli. Piaget's studies similarily point out that the ontogenetic levels of development are characterized by a progression from global perception to more refined modes of perceiving.

As a method of measuring Witkin's field-dependence-independence construct several tests have been devised which are all highly inter-correlated. These include the Rod and Frame test, the Tilting-Room-Tilting-Chair test and the Embedded Figures test. The rationale underlying these tests is based upon the hypothesis that the more accurate the performance, the better able is the subject to attend to relevant stimuli. Gardner, et al (1962) state "the tests of dependence-independence measure the capacity (of the individual) to attend and respond to relevant cues" (p. 193). The field-independent subjects are unable to differentiate as well between relevant and distracting stimuli as the field-dependent.

In relating the construct of field-dependence-independence to personality characteristics, Block (1957) experimenting with a group of high GSR reactive subjects and a group of low GSR reactive subjects, found that the high GSR reactors were more dreamy, idealistic, suggestive and introversive and were also more field-dependent. The low reactors were more clever, cool, evasive, independent, ingenious, leisurely, opportunistic, practical and realistic and were also more field-independent.

Using the semantic differential, Rudin and Stagner (1958) found that field-dependent subjects show greater variability in self-concept from one social setting to another.than do field-independent subjects. This finding suggests that the field-dependent subjects tend to be anchored to their social contexts for the development of a concept of their own.

Jackson (1957) relating intelligence and field-dependence-independence found a correlation of 155 between ACE scores and his short form of the Embedded Figures Test. Goodenough and Karp (1961) further studied this relationship with young children. Three WISC sub-tests; block design, picture completion and object assembly were found to correlate significantly with the factor field-dependence-independence. From these results, it appears that only performance measures are related to the field-dependence dimension and that it is not a general intelligence factor.

The second construct theoretically linked to field-articulation is described by Klein (1954) as Constriction-Flexibility. The test which Klein used to measure Constriction-Flexibility is the Stroop Color-Word Test. This test requires the subject to report from a list of color names, not the words printed, but the color in which each name is printed. The time required to report the requested information is considered to be an indication of his "flexibility" in changing from a familiar set to an unfamiliar set. The "flexibile" individual is able to shift his set more quickly and disregard interfering information.

Silverman (1964) in his review of the literature on the schizophrenic and field-articulation made the following observations:

(a) Minimal field articulating schizophrenics appear to avoid anxiety by directing their attention away from the environment and onto internal processes such as hallucinations.

(b) Extensive field articulation responses are associated with the paranoid subtype whereas undifferentiated field articulation responses are associated with the catatonic, simple and hebephrenic subtypes.

(c) Undifferentiated field articulation responsiveness is characteristic of process schizophrenics. Reactive schizophrenics evidence a more highly articulated field responsiveness.

(d) A disposition toward either high or low field articulation is present early in the course of development.

Before leaving this section, several important issues require further elaboration: (1) How does scanning and field-articulation relate to information intake? (2) How do personality categories relate to information intake?

With regard to the first issue, the research reviewed in this section has suggested that scanning and field-articulation may have particular relevance to the regulation of information intake. Bruner (1957) uses the phrase "scanning the environment" to describe the active process of searching cues preliminary to identification. Gardner, et al (1959) describes the extreme scanner as actively

pursuing objects about him and continuously searching for new cues. Lashley (1951) asserts that the same shape which can scarcely be distinguished with passive touch "can readily be distinguished when (actively) explored by tactile scanning." (p. 128)

Studies which emphasize perceptual scanning seem to support the notion that the mode of scanning is related to information intake. Inferences drawn from laboratory tasks suggest that extensive scanners sample a wider range of stimuli than limited scanners. Other studies which emphasize field-articulation suggest that individuals differ in their articulation or selection of salient and irrelevant cues. The more accurate the response of subjects on field-articulation tasks, the better able is he to attend to relevant stimuli.

With regard to the second concern, namely the relationship between personality categories and information intake, we have reviewed several studies which have found significant relationships between perceptual response dispositions and personality categories. Noteable among these is Silverman's (1964) finding concerning the problem of attention and schizophrenia. His studies suggest "that schizophrenic resolution appears to be associated with changes in attention response style." (p. 376) Although difficult to interpret to relatively normal individuals, Silverman's work provides suggestive hypotheses. One such hypothesis is that the attention response style of individuals although relatively stable may change in the direction of becoming more sensitive to environmental change.

Other studies have related the factors scanning and articulation to such variables as Extroversion-Introversion, intelligence, anxiety, alcoholism, sex, age, and problems of identity. From these studies it may be hypothesized that certain personality factors may be associated with high levels of information intake whereas others may be associated with restricted information input.

Menninger (1963) describes such a possible relationship between neurosis and information intake when he states:

> That the essential qualitative change in neurosis is a slight but definite detachment of a person from his environment. There is a distinct lowering of performance and achievement. The ability to correctly identify and evaluate aspects and objects of external reality is lowered. Work, play, productivity and social inter-course are usually to some extent impaired. When the real world is shut out, when the normal sources of energy, stimulation, new information correct bearings and the like are in any way diminished, there is a partial or threatened closure of the ego system.

Summary of the Literature

Literature has been reviewed in this chapter which provides the scope for the development of the experimental design. Thre main lines of psychological study have been reviewed. These include: (a) Gibson's Theory of Perception; (b) Lacy's Theory of Directional Fractionation of Response; (c) and research relating personality characteristics to perception and diagnostic categories.

Gibson's theory of perception has provided the model upon which to base information intake measures. The theory is basically concerned

with a description of the organism's ability to maintain contact with his environment. Exploratory behavior isolates the invariants in the flux of stimulus energy. The sensory system through the activity of the sensory receptors scans the environment. Sensory receptors may be educated to select certain invariances through their active or passive state. Perception is dependent upon stimulus variables. No intervening variables are presumed.

As a method of testing aspects of his theory, Gibson has developed matching tasks. These tasks were designed to measure the amount of information received through active and passive touch and vision. (scanning the environment) Pettifor (1964) used the tasks to demonstrate that pathological groups do not take in information as efficiently as a normal group, He found that the normal group differed significantly in the efficiency of information intake from the ulcer group and favored the controls in the neurotic and orthopedic groups.

Gibson's matching tasks (called "feelees") are of direct relevance to this study since they will be used to obtain measures of information intake. Correct matchings and resultant high scores are readily made by the subject when the objects are actively explored by tactile and visual scanning. (Gibson, 1962, p. 486)

In the theory of Directional Fractionation of Response, Lacy hypothesized that cardiac deceleration accompanies and perhaps even facilitates ease of information intake, whereas cardiac acceleration accompanies or facilitates a rejection of information intake. Support

for this hypothesis was presented from the experimental studies of a group of researchers.

In the last section of the reviewed literature, research studies were reviewed which tended to support the notion that personality traits may be related to the efficiency of information intake. It was pointed out that information input is influenced by the factors, scanning and field-articulation or as Gardner, et al (1961) states: "both principles are relevant to situations in which the subject must attend (a) to stimuli outside himself or (b) to elements of memory schemata within himself." (p. 120) In this study, an identification of stimuli outside of the individual has been a primary concern.

The Problem

The reviewed literature suggests that personality traits, heart rate, GSR and information intake may be related. The purpose of the present study was to further examine these suggested relationships.

Hypotheses

The hypotheses to be tested in this study are as follows:

Hypothesis I

There are significant relationships between measures of personality, heart rate, GSR and information intake as measured by the number

correct on Gibson's "feelee tasks"

(a) Heart rate will decrease during information intake

(b) GSR will increase during information intake

Hypothesis II

There are significant relationships between measures of personality, heart rate, GSR and the total time required to reach a decision on Gibson's "feelee tasks."

CHAPTER II

EXPERIMENTAL DESIGN

The Sample

The subjects selected for this study were 72 male university students whose mean age was 25 years, 8 months and who had an age range from 19 years, 5 months to 42 years, 3 months. One subject showed signs of physical disability and was not included in the calculations. All the subjects were unpaid but received incentives from their instructors.

Measuring Instruments

The measuring instruments used in this study fell into three major groups: personality, perceptual and physiological.

Personality Measures

Several criteria guided the search for personality measures used in this study. First, the tests used must require as little of the subject's time as possible and be as unlikely as possible to generate resistance. Second, the results should be in objective form so that they be readily available for statistical treatment. Third, it was deemed desirable to obtain as broad a spectrum of personality traits as possible. Lastly, the personality tests used should fit the model being developed. This last requirement was difficult to fill since little prior information was available on the personality

correlates of efficiency in information intake and physiological responsiveness.

The method of best satisfying the four requirements mentioned seemed to lie in the use of tests developed by means of factor analysis. This method identified relatively independent and functionally unitary factors or traits. Cattell (1958) contends that the factor analytic approach to personality testing can provide a means of extracting order from a mass of abilities, attitudes, feelings and modes of action. There are two personality measures which have been developed over an extensive period of time and generally meet the requirements of this study. These are the inventories developed by Guilford, Zimmerman and Cattell.

Guilford-Zimmerman Temperament Survey

The Guilford-Zimmerman Temperament Survey is a revision of three Guilford-Martin personality tests. These include the Guilford-Martin Inventory of Factors, GAMIN, the Guilford-Martin Inventory of Factors, STDCK, and the Guilford-Zimmerman Personnel Inventory.

The Guilford-Zimmerman Temperament Survey is the product of almost thirty years of continuous development. The test consists of the 300 most discriminative items selected from a total of 511 items which composed the three previous tests (Guilford-Zimmerman 1963) There are ten factors measured as compared to thirteen factors in the combined previous tests. Three factors were eliminated because they were found to correlate highly with existing factors. The test is set

up in such a manner that there are thirty items in each of the ten subtests. Each question can be answered by indicating a "yes," "?" or "no."

This revision of the Guilford-Martin battery of tests has resulted in increased reliability and lower intercorrelations between factors. Norm data were obtained from 523 male and 389 female college students with a mean age of twenty-three. Estimates of the total score reliabilities were made in various ways with the best estimates of the reliability coefficients of the various separate factors ranging from .75 for Factors O and F to .87 for Factor S. In general, the intercorrelations between the trait scores were low. Half of them were below plus or minus .25. Only two of the forty-five intercorrelations were above .60, and in each of these cases one score accounts for less than half of the variance of the other score.

The validity evidence for this test can best be summarized in the author's words:

> The internal validity or factorial validity of the scores is fairly well assured by the foundation of factor analysis studies plus the successive item analyses directed toward internal consistency and uniqueness. It is believed that what each score measures is fairly well defined and that the score represents a confirmed dimension of personality and a dependable descriptive category. Evidence of practical validity based upon correlation studies with practical criteria of adjustment has accumulated. The evidence which arose in connection with corresponding studies in previous inventories can be applied with confidence to the scores in the present study. (Guilford-Zimmerman, 1964, p. 6).

Stephenson (1949) considers this inventory better than most similar inventories and says that its data and supporting norms are all adequate, thorough, and factually oriented. Saunders (1959) however questions the validity studies. Studies in which these tests have been validated have employed relatively non-specific criteria. On the other hand, Shaffer (1950) calls it the outstanding omnibus instrument based primarily on factor analysis and considers it useful as a research tool.

Studies reported by North (1949) which were based on the earlier versions of this test suggest that several of the factors, especially those relating to emotional control, can be grouped into meaningful clusters.

The ten personality trait factors for which measures are obtained are:

Factor G. General Activity. This factor purports to measure energy and the amount of overt activity exhibited by a person. Personality characteristics related to a high score on this variable are strong drive, energy and vitality, rapid pace of activities, production and efficiency, hurrying, and enthusiasm. A low score would suggest such qualities as slow and deliberate pace, fatigueability, inefficiency, and low productivity.

Factor R. Restraint. High scores are indicative of seriousmindedness, deliberation, persistent effort, and self-control. Low scores tend to be found in persons described as happy-go-lucky,

carefree, impulsive, and excitable.

Factor A. Ascendance. High scores are found in persons who are said to stand up for their own rights, have qualities of leadership, are conspicuous, and mix with others. Low scores are related to suspiciousness and habits of following.

Factor S. Sociability. At the high end of this continuum may be found such qualities in people as having many friends and acquaintances, entering easily into conversation, seeking the limelight, and seeking social contacts. At the low end are found qualities such as having few friends and acquaintances, being shy, and avoiding social contacts.

Factor E. Emotional Stability. High scores are in the direction of evenness of moods and interests, optimism and cheerfulness, composure and feelings of good health. Low scores suggest fluctuating moods, pessimism, daydreaming, excitability, feelings of ill health, and feelings of guilt or worry.

Factor O. Objectivity. High scores indicate a person who is "thick-skinned" and "insulated," and able to view others in a detached, impassionate manner. Low scores suggest hypersensitivity, self-centeredness, suspiciousness, and hostility.

Factor F. Friendliness. This factor was formerly called agreeableness. Toleration of hostile action, acceptance of domination, and respect for others are reflected by a high score. A low score indicates belligerence, hostility, desire to dominate, and contempt

for others.

Factor T. Thoughtfulness. High scores are indicative of reflectiveness, meditativeness, interest in thinking, observation of self and others, and showing mental poise. At the other extreme is an inclination for overt activity, a dislike to think things out, as well as feelings of mental disconcertedness.

Factor P. Personal Relations. A high score on this trait would suggest a toleration of people, faith in social institutions, and an ability to get along smoothly with people. Persons with low scores are apt to be hypercritical and fault-finding, suspicious of others, and have feelings of self-pity.

Factor M. Masculinity. High scores reflect masculine interests, being "hard-boiled," fearless, and inhibiting emotional expression. Low scores reflect interest in feminine activities, emotional expressiveness, fearfulness, feelings of sympathy, and romantic interests.

Cattell Sixteen Personality Factor Questionnaire

The second inventory included in the personality measurement battery was the Cattell Sixteen Personality Factor Questionnaire, Form C. (Cattell, 1964). It was developed by means of factor analysis and is designed to take cognizance of the total personality.

Cattell (1964) described the construction of the test in the following terms:

> Some of the finest factor analytic research has been devoted to the test's construction. A whole series of research publications testify to a very broad sampling of the area of personality responses; the achievement of a true simple structure solution revealing functionally unitary traits, thrice checked by independent experiment; a repeated intensification of item loadings; a standardization on a proper variety of groups and a systematic accumulation of relations to important criteria. (p. 6)

The author is not specific but the adult standardization group appears to be 1,033 subjects. He refers to a large number of reliability and validity studies, but few such data are available in the manual. Corrected split half consistency coefficients obtained on the largest sample (450 males) for each of the sixteen factors vary from .71 to .91. Of the 120 intercorrelations between factors, none exceeded .40 in the sample reported and four-fifths of these were of the magnitude of less than .15. The mean validity for the A, B and C forms of the test ranged from .73 - .91.

The 16 P.F. includes a measure of intelligence. This factor is of importance because there is reason to believe that information intake is to some extent related to intelligence and to physiological responsiveness. (Krasner, 1953).

A brief description of the factors or traits is as follows:

Factor A. Cyclothymia versus Schizothymia. The dichotomy described is good-natured, easy-going, cooperative, attentive, trustful, adaptive, and warm-hearted, versus spiteful, griping, critical, obstructive, cruel, aloof, rigid, and suspicious. The author reports that persons with high scores on this variable are more interested in

people and more readily form active social groups while low scorers are inclined to be more interested in ideas and "things."

Factor B. General Intelligence versus Mental Defect. Scores on this factor are obtained from answers to thirteen analogy items.

Factor C. Emotional Stability or Ego Strength versus Dissatisfied Emotionality. This factor has been described as one of dynamic integration and maturity as opposed to general emotionality. Some of the terms used to describe high scores on the test are emotional maturity and stability, calmness, passiveness, realistic about life, and absence of neurotic fatigue. General emotionality, lack of frustration tolerance, changeability, worrying, evasiveness, and neurotic fatigue characterize those obtaining low scores.

Factor E. Dominance or Ascendance versus Submission. Persons obtaining high scores are described as assertive, self-assured, independent, hard, solemn, tough, and attention-getting versus submissive, dependent, soft-hearted, expressive, conventional, and easily upset for those obtaining low scores.

Factor F. Surgency versus Desurgency or Depressive Anxiety. The surgent end of this scale indicates a person who is talkative, cheerful, placid, frank, and quick and alert. The desurgent end indicates a silent, introspective, depressed, anxious, uncommunicative, and languid person.

Factor G. Character or Superego Strength versus Lack of Internal Standards. This factor might be described in psychoanalytic

terms as reflecting "superego strength" while Factor C could be described as measuring "ego strength." Associated with high scores are terms such as persevering, responsible, emotionally mature, well ordered, and conscientious. Persons with high scores have been described as viewing themselves as guardians of manners and morals, cautious, able to concentrate, and interested in analyzing people.

Factor H. Adventurous Autonomic Resilience versus Inherent Withdrawn Schizothymia. The low scores probably represent the withdrawn, careful, well-behaved person who reports himself to be intensely shy, convinced of his inferiorities, and is slow and impeded in expressing himself. Other descriptions are cautiousness, retiring, low interest in the opposite sex, conscientiousness, coolness, and aloofness. Factors which make up a high H score are gregariousness, sociability, boldness, marked interest in the opposite sex, abundant emotional response, and strong artistic or sentimental interest. This factor is of particular interest in the present study because of its demonstrated relationship to GSR and other physiological factors. (Cattell, 1955; p. 291). Cattell states that this is one of the best defined of the factors he has isolated and feels that it reflects ability to withstand repeated emotional stress. He hypothesizes that it may represent some large constitutional factor which gives rise to social, sexual, and emotional orientation.

Factor I. Emotional Sensitivity versus Tough Maturity. Individuals obtaining high scores on this factor are described as

demanding, immature, dependent, introspective, gentle, emotional labile, and sympathetic as opposed to those with low scores who are described as emotionally mature, independent, smug, self-sufficient, responsible, and lacking artistic feelings.

Factor L. Paranoid Schizothymia versus Trustful Altruism. High scores are associated with proneness to jealousy, shyness, bashfulness, suspiciousness, hardness, rigidity, and lack of concern for other people. A person who obtains a low score on this factor is described as free of jealous tendencies, composed, trustful, cheerful, adaptable, and concerned about other people.

Factor M. Hysteric Unconcern (or "Bohemianism") versus Practical Concernedness. Among the adjectives describing persons with high scores are unconventional, sensitively, imaginative, undependable, placid exterior, and occasional hysterical emotions versus conventional, practical, logical, easily concerned, expressive, and given to using one's head in emergencies. People with high scores may walk and talk in their sleep, do not hesitate to make demands on others and are not concerned with conventions.

Factor N. Sophistication versus Rough Simplicity. Persons with high scores on this factor are described as polished, cool, aloof, and fastidious. Individuals with low scores are described as clumsy, awkward, attentive to people, and easily pleased.

Factor O. Anxious Insecurity versus Placid Self-Confidence. Persons with high scores are described as anxious, worrying, suspicious,

and brooding. Individuals with low scores are described as placid, tough, and given to simple actions. The person with a high score tends to describe himself as feeling downhearted, often remorseful, subject to phobias, avoiding people, and worrying. Probably more than anything else it is an indication of the level of free-floating type of anxiety.

Factor Q_1. Radicalism versus Conservatism. This factor seems to be largely an attitudinal factor rather than a strict personality factor. A radical person is described as interest in intellectual matters and fundamental issues, is more introspective, is well informed, less inclined to moralize, and more inclined to experiment with life generally.

Factor Q_2. Independent Self-Sufficiency versus Lack of Resolution. High scores are suggestive of persons who are not necessarily dominant in social relations but tend to go their own way. The low scores are associated with persons who like social approval, are conventional, and prefer to work in company with others.

Factor Q_3. High Self-Sentiment Formation versus Poor Self-Sentiment Formation. A high Q_3 score designates controlled and exacting will power. Persons with high scores show socially approved character responses, self-control, persistence, foresight, considerateness of others and conscientiousness. A low Q_3 score represents uncontrol and laxness. Clinically, Q_3 reflects the extent to which the person has crystallized for himself a clear and consistent pattern

of socially approved behaviour to which he strives to conform.

Factor Q4. High Ergic Tension versus Low Ergic Tension. A high Q4 score represents a level of excitement and tension representing undischarged and partly uncontrollable energy. It is best described as energy excited in excess of the ego strength capacity to discharge it, and which is therefore misdirected, converted into psychosomatic disturbances and anxiety and is generally disrupted of steady application and emotional balance. Low Q4 represents the tendency toward being phlegmatic and composed.

Cattell Second Order Factors

The 16 P.F. Questionnaire had its factor structure redetermined with particular attention to exact rotation to the best simple structure. The correlations determined by inversion of the reference vector matrix among the 15 primaries (intelligence was omitted) factored to four second-order simple structure factors (Cattell, 1956). The two main Second-Order Factor scores derivable from 16 P.F. are the Anxiety-vs-Dynamic Integration factor and Extraversion-vs-Introversion factor.

The following two figures provide the weights and factors necessary for the calculation of the Second-Order Anxiety Factor and the Second-Order Introversion and Extraversion Factor.

Primary Factor Concerned	WEIGHTS More Exact	Rounded
C	-.18	-.2
H	-.17	-.2
L	+.19	+.2
O	+.30	+.3
Q_3	-.20	-.2
Q_4	+.38	_.4
	Plus constant 3.74	

Cattell, 1964, p. 32

Figure II

Factor Score Combination for Estimating the Second-Order Anxiety Factor

Primary Factor Concerned	WEIGHTS More Exact	Rounded
A	+.17	+.2
E	+.33	+.3
F	+.41	+.4
H	+.48	+.5
Q_2	-.16	-.2
	Plus constant -1.26	

Cattell, 1964, p. 32

Figure III

Factor Score Combination for Estimating the Second-Order Introversion-Extraversion Factor

Information Intake Measures

Since this study relies heavily on Gibson's theory of perception, use of the apparatus developed by Gibson at Cornell University is being used. The tasks used were two sets of solid plastic objects, each four inches high and weighing eight ounces. Each object varies considerably from another but each has six curved protuberances on the front half and a convex rear half. Valleys or saddles of varying depth and distribution separate the protuberances which are asymetrically situated. The Cornell objects have no palmar surface but can be set erect on the edge of the curved back and the two leading lower protuberances. There are two identical sets of objects consisting of ten in each set.

The objects used in this study correspond to the originals. Since the originals were unavailable, Pettifor (1964) sculptured two sets from 2½" spheres of clay that differ from the Cornell objects in that there is a small planar surface on the bottom to enable the object to stand securely upon the table-bench. A black pigment was added to the clear liquid plastic before it was poured into the mould so that each object has a uniform black surface.

A table-bench with dimensions of 40" long, 10" high, 4" wide at top and with an 8" side base, was positioned on the testing table so that the subject's right elbow could rest on the table and his right hand could extend beneath the bench. A set of ten objects was positioned in a definite order by number, 1½ inches apart and one inch

from the leading edge of the bench. The position number of each object was stencilled on the bench and was easily read by the subject. An opaque cloth 40" by 14" was draped from the leading edge of the table-bench.

Seven objects from another identical set were placed in a box out of sight of the subject and presented in a standardized order as shown on the score sheet. In order that a uniform field of vision was obtained, the subject's position was established so that his nose pointed directly at the midpoint of the table-bench.

Physiological Measures

Since this study was to a large extent based upon Lacy's experimental and theoretical work, the physiological measures GSR and heart-rate were used. The physiological recordings in this experiment were made simultaneously by means of a polygraph.(Grass Model SD)

Channel I - Signal Marker and Time Marker

By means of the signal marker, the exact time of presentation of each stimulus, its duration and time of removal was recorded on the polygraph tape simultaneously with the physiological responses. The time marker provided a convenient method of calculating the length of time in seconds that elapsed during and between stimulus presentations. All stimuli were easily identified by the use of a predetermined system of coded marker signals.

Channel II - Galvanic Skin Response

GSR was measured by means of the determination of the resis-

tance of the skin to an externally applied current (Fere Effect; McLery, 1950; Lindsley, 1951). This required the use of a Grass Converted Demodulator, Model 5 PIK M37553 as the current source. This device also served to modify the fluctuating direct current, in order that it could be detected and amplified by EEG amplifier. The output of the Converted-Demodulator fed directly to the preamplifier of Channel II. Two electrodes were attached directly to the palmar surface of the left hand by means of a specially constructed fastener. This equipment prevented the hand from moving and thus prevented a chemical change in the polarization and conductance levels.

Before the hand was fastened to the electrodes, it was cleaned by use of rubbing alcohol absorbed in a soft tissue paper. Contact with the skin was made by means of a commercially prepared "EKG SOL" electrode paste. This paste is recommended for maintaining electrode stability and for holding polarization effects at a minimum. The electrodes were mounted in a specially constructed holder which was made to conform to the curvature of the hand. They were attached to the hand by means of a bolt and screw device which provided the electrodes with a constant pressure against the skin.

Channel III - Heart Rate

The electrical activity of the heart was obtained by attaching electrodes to the left arm and left leg. A conventional electrocardiograph lead II was used and heart activity recorded directly through the EEG amplifier model 5P4D E47H5.

Nine separate counts of heart rate were made for each subject. Seven counts were made during the presentation of perceptual tasks and two counts during the period of rest.

Procedure

Personality Inventory Administration

At the first personality testing session, all subjects were informed of the general nature of the procedures and apparatus they would encounter during the study and were given assurance that anonymity of individual results would be preserved.

The Guilford-Zimmerman Temperament Survey and the Cattell Sixteen Personality Factor Test were administered according to standard procedures to all subjects. Due to schedule difficulties, some tests were administered in class periods and others were administered individually.

Perceptual and Physiological Measurement Administration

Following completion of the personality tests, each subject was seen individually for approximately 1/2 to 3/4 hours, at which time the perceptual tasks were presented and the physiological readings made. The experimental room was a large laboratory with a specially constructed booth in which the subject remained during all measurements. The booth was painted black, and contained a large chair upon which the subject sat and a table upon which the Gibson perceptual objects were placed. The polygraph was placed outside of the booth and operated by an experimental assistant. The apparatus,

except for the electrodes attached to the subject's body, was outside of the booth and not observable by him.

The arrangements of the apparatus and the design of experiment made it necessary to place one experimenter in the booth presenting the perceptual tasks and another outside of the booth monitoring the polygraph controls. This person remained quiet and out of view of the subject.

After all leads were attached and controls adjusted, continuous physiological recordings were obtained until the end of the experiment. The following experimental periods may be identified:

(1) Initial Period of Silence

Instructions for this period consisted of reassuring the subjects that they had nothing to do but relax and remain as quiet as possible. They were asked to place their head on the back of the cushioned chair and close their eyes. Reassurance was given as needed after which the experimenter left the booth.

This initial period lasted from 5 to 15 minutes. This time allowed the subject to relax and provide time for the experimenter to establish a baseline for the physiological measurements. The period continued until little variability could be observed in any of the physiological readings.

(2) Perceptual Task Instructions

Following the period of rest, the experimenter entered

the booth and gave the following instructions:

You will notice that there are ten objects placed on the table. They are numbered one to ten; beginning at your left is number one and at your right is number ten. Please place your right hand under the cloth. I will place next to your hand and facing you an object identical to one of those on the table in front of you.

The purpose of this task is to match the objects that are in front of you with the object that I will place next to your hand. You will be timed on how long it takes you to reach a decision on the match. Call out the number of the object that matches the one next to your hand as soon as you have reached a decision.

The word "presentation" was the signal to the polygraph operator to mark the beginning of the perceptual matching period on the time calibrated polygraph paper.

(3) Perceptual Task Matching Period

The point in time in which the object was presented to the subject was recorded and again at the exact time in which a decision was reached. These recordings were obtained by use of a stop-watch.

The experimenter also recorded on a specially prepared form whether the decision was right or wrong. There were a total of seven perceptual task matching periods. At the beginning of each period a different object was presented.

(4) Period of Rest

After the decision had been reached and verbalized by the subject, a period of 3/4 to three minutes rest was given to the subject. The subject was asked to relax, close his

eyes and place his head on the cushioned chair. This period also allowed the polygraph operator to re-establish base-line levels. Six periods of rest were provided.

(5) Post-Stimulus Relaxation

After the seventh presentation of the perceptual task, a period of relaxation was provided. This period lasted approximately five minutes and provided recordings of the subject at rest. During this time, the subject was asked to close his eyes and relax as much as possible with his head on the back of the cushioned chair.

Quantifying Physiological, Perceptual and Personality Measurements

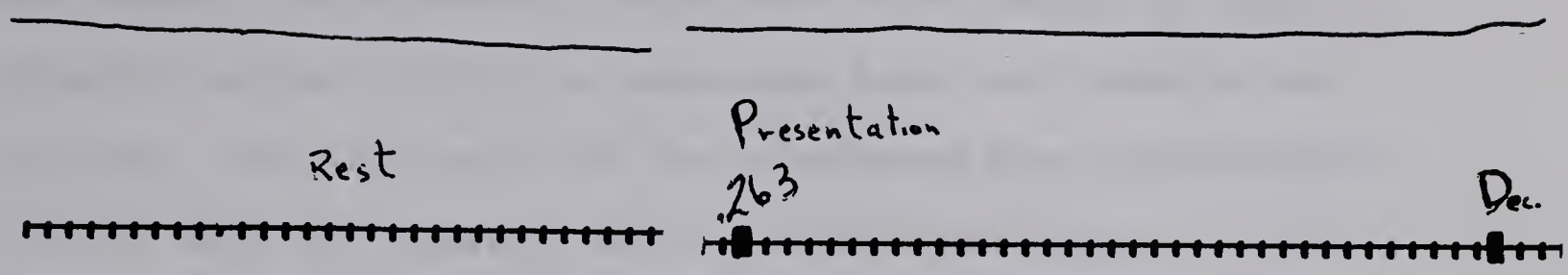
Quantifying the Galvanic Skin Response

There are various ways of quantifying the GSR and there is little agreement as to which method is best. (Lacy, 1961; McLeary, 1950; Lacy and Siegel, 1949). The method employed in this study takes account of the maximum deflection in response to the stimulus according to the method outlined by Lacy and Siegel (1949). Examples of GSR recordings are shown in Figure IV, recordings A and B. Recording A shows a very slight GSR response. Recording B shows a heavy response.

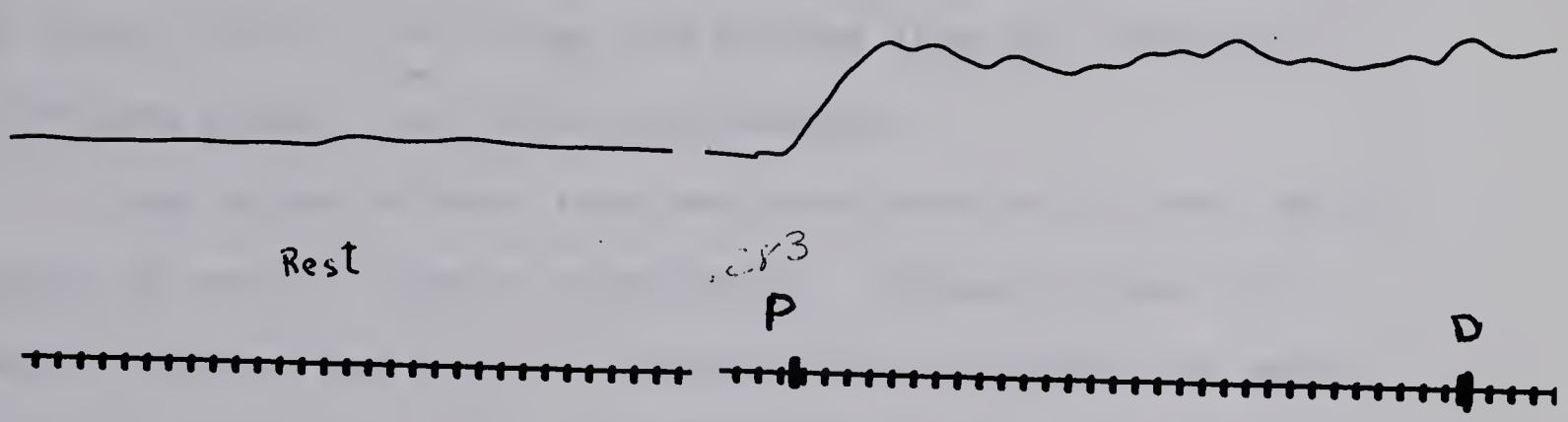
FIGURE IV

RECORDINGS OF PHYSIOLOGICAL MEASUREMENTS

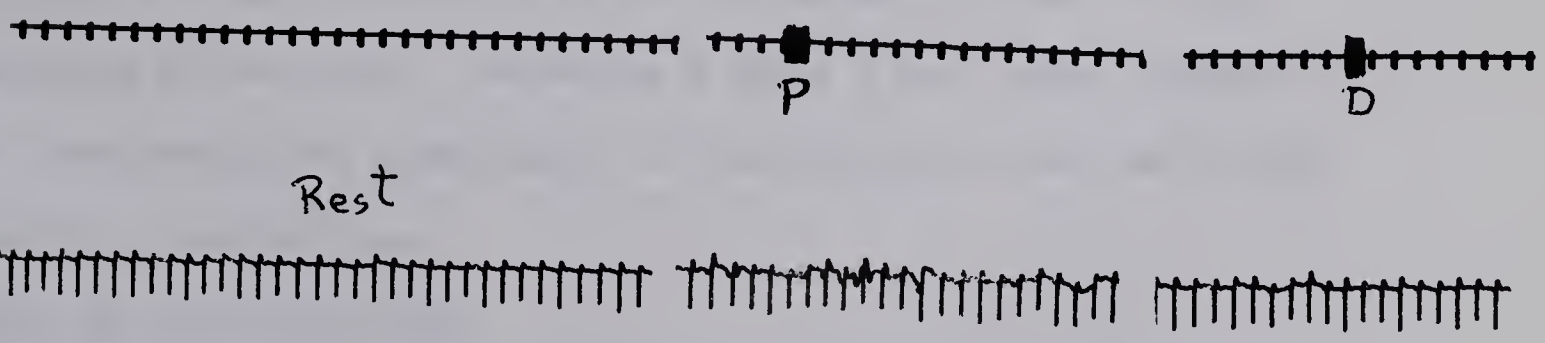
G S R Recording A



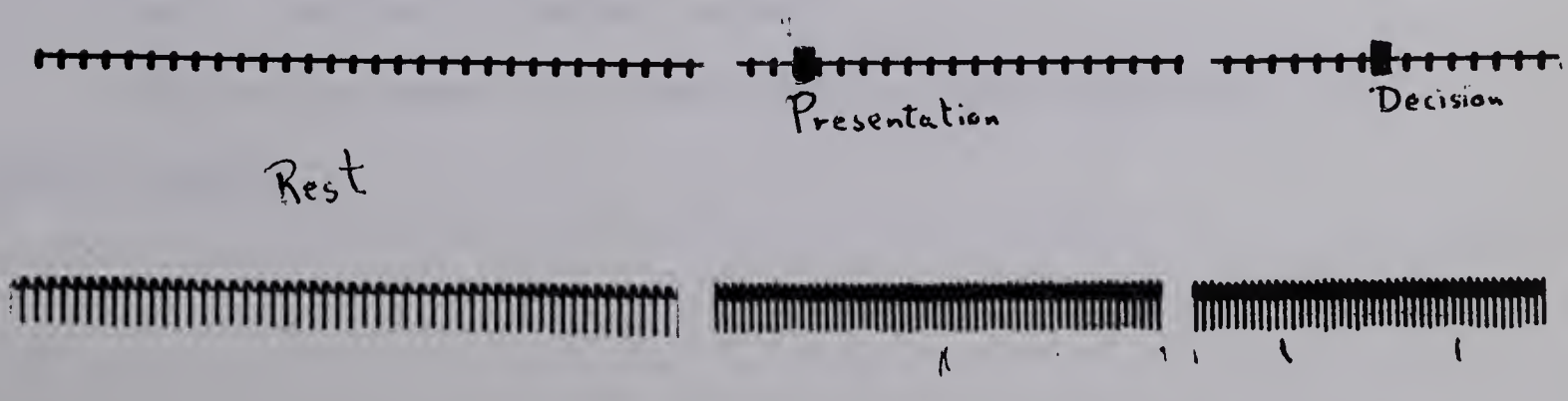
G S R Recording B



Heart-Rate Recording C



Heart-Rate Recording D



Quantifying Heart Rate

The measurement of heart rate was obtained by counting the R-wave spikes. The difference in heart rate during periods of rest and during the periods in which the perceptual tasks were presented were calculated. The first period of rest measurement began approximately 5 minutes after the apparatus had been attached and lasted 5 minutes. The period of rest varied somewhat depending upon the anxiety level of the subject and the time required for the basal level to stabilize. The second period of rest began give minutes after the presentation of the last stimulus and lasted three minutes.

Mean values of heart rate were calculated in all cases during periods of rest and stimulus presentation. Increase in heart rate taken during rest and stimulus presentation was calculated as percent increase. Examples of heart rate recordings are shown on Figure IV, recordings C and D. Recording C shows a very slight increase in heart rate during presentation of the perceptual task and during verbalizing the decision. Recording B shows a very large increase in heart rate during the presentation of the perceptual task and during verbalizing the decision.

Scoring of Perceptual Tasks

Three perceptual task measured were obtained. These included the following:

(a) Accuracy or Number Correct.

This is the number of correct tactile visual matchings of the plastic objects.

(b) Time.

Time is defined as the average time taken to make the matchings and verbalize the decision regardless of accuracy.

Statistical Analysis

Correlations

Product-moment correlations were calculated between the physiological variables, information intake variables and twenty-six personality factor scores. This 33 by 33 correlation matrix yielded 528 intercorrelations which were tested for significance using the formula suggested by Ferguson (1959, p. 152).

Where the relationships between the variables was found to be curvilinear, Multiple Linear Regression Analysis was utilized (Bottenberg and Ward, 1963).

Factor Analysis

An attempt was made to determine the existence of some common variable which all the tests were measuring, to some extent. This common variable can be mathematically expressed as a "factor." A factor may be summarized as a hypothetical variable common to several tests. Factor loadings are quantities which express the extent to which each individual test in a battery measures the particular factor under consideration.

The Unrotated Factor Matrix

The 33 by 33 correlation matrix was subjected to principal

axis analysis. The arithmetic computations involved were carried out on the University of Alberta's IBM 7040 computing system. The program developed by Harman (1960, pp. 185-191) was employed.

The Varimax Factor Rotation

As a means of simplifying the columns or factors of the factor matrix in an attempt to meet the requirements for simple structure, analytical rotations were carried out, using Kaiser's (1958) normal varimax techniques (Harman, 1960, p. 301). The rotations tend to destroy the uniqueness of the Principal Axis solution but lend parsimony and ease of interpretation to the factoral structure (Harman, 1960, p. 292).

CHAPTER III

RESULTS

The experimental results from this study are arranged and reported in this chapter and may be considered as falling into the following two categories. (The appendix contains the raw scores upon which the statistical analyses were carried out.)

1. Findings regarding the relationship between GSR, heart rate, personality and number correct on Gibson's "feelee tasks."

2. Findings regarding the relationship between GSR, heart rate, personality and total time required to reach a decision using Gibson's "feelee tasks."

Intercorrelations

The Pearson product-moment intercorrelation of the 33 variables measured are reported in Table I. For these correlations based upon 71 subjects, an r of .302 was required to reach the .01 level of significance, an r of .233 was required for the .05 level and an r of .20 was required for the .10 level.

When such large numbers of intercorrelations as these are derived, one may expect some to appear statistically significant purely on the basis of chance. However, a much greater than chance number of significant correlations were obtained in the complete matrix. Forty-six intercorrelations were found to be statistically

significant at or beyond the .01 level or better as compared to 5 expected by chance alone. At the .05 level, 96 were found to be significant as compared to 27 expected by chance. At the .01 level, 111 correlations were found to be statistically significant when only 52 might be expected on the basis of chance.

Curvilinear relationships were tested using the Datran subroutine of the Persub battery. Vectors were entered into the unrestricted model to determine whether or not the predictors did relate to criterion performance. The findings are reported in Table IV.

The Unrotated Factor Matrix

By use of factor analysis, an attempt was made to determine the common sources of variation. These common sources of variation are mathematically expressed as "factors." In calculating the factors, the intercorrelation matrix reported in Table I had unity inserted into the diagnals and the characteristic equations known as eigenvalues were computed. Of the 33 eigenvalues, the first 10 exceeding one were retained. Factor loadings were obtained by multiplying the square root of each eigenvalue by its corresponding eigenvector. Table II reports the results of the computations. Included also are sums of squares and the percentages of common and total variance.

Varimax Rotation

The purpose of applying varimax rotation was to simplify the rows and the columns of the factor matrix in order to meet the

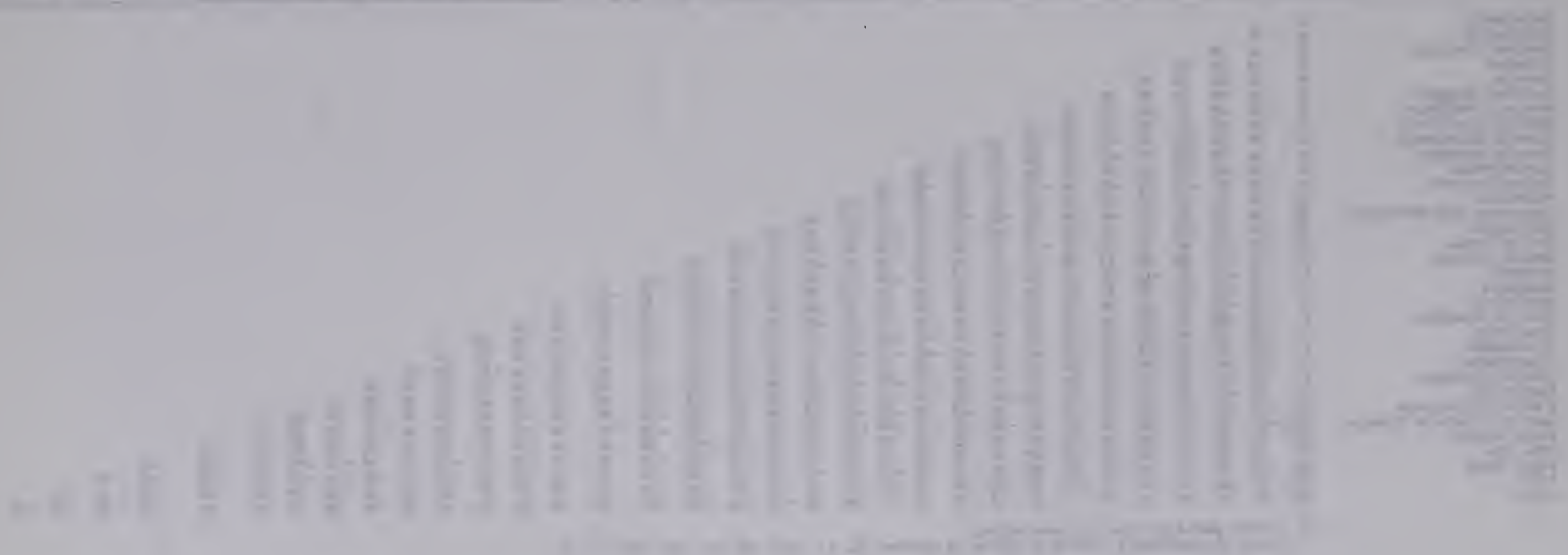
TABLE I

SUMMARY OF CORRELATIONS BETWEEN PERSONALITY MEASURES,

INFORMATION INTAKE SCORES AND PHYSIOLOGICAL MEASURES

Variable	Code	A	B	C	E	F	G	H	I	L	M	N	O	Q_1	Q_2	Q_3	Q_4	G	R	A	S	E	O	F	T	P	M	HRI	HRDI	NC	TT	NW	PES	GSR
Cyclothymia	A																																	
Intelligence	B	-06																																
Emotional Stability	C	04	08																															
Dominance	E	13	-15	24																														
Surgency	F	26	-06	10	35																													
Character Strength	G	-04	-28	-27	-07	02																												
Autonomic Resilience	H	-01	-09	34	-04	15	03																											
Emotional Sensitivity	I	32	06	-11	14	07	05	-25																										
Paranoid Schizothymia	L	09	-13	-31	02	-13	18	-13	08																									
Hysteric Unconcern	M	04	07	-20	00	-04	02	04	00	10																								
Sophistication	N	04	-11	-00	18	24	00	14	-17	17	00																							
Anxious Insevrity	O	-01	-16	-24	-29	-22	08	-21	-03	24	-02	00																						
Radicalism	Q_1	06	16	17	23	11	-18	04	04	-09	08	07	-22																					
Independent Self-Sufficiency	Q_2	-26	14	21	18	-09	-09	03	-26	-08	17	10	-04	19																				
Will Control	Q_3	-10	06	-40	00	02	-12	29	-20	-05	00	-07	-24	18	17																			
Nervous Tension	Q_4	-19	-16	40	03	-12	26	-19	21	25	-05	-01	22	-18	-03	-45																		
General Activity	G	10	-17	08	06	17	22	06	-07	04	-06	37	06	-08	15	01	01																	
Restraint	R	-29	-04	01	-14	-18	15	08	-10	-15	12	-20	-15	15	21	36	-07	-23																
Ascendance	A	28	-14	-15	29	51	03	28	-15	15	07	25	-07	06	10	09	-16	27	-09															
Sociability	S	38	-00	10	11	48	06	35	-02	06	-03	23	02	-02	-16	-06	-14	33	-29	62														
Emotional Stability	E	-02	-01	45	-16	12	-02	33	-23	-25	-20	-07	-10	-06	15	33	-39	15	20	25	21													
Objectivity	O	12	09	42	-05	03	-20	26	-08	-32	-11	04	-27	06	19	17	-41	10	05	29	26	68												
Friendliness	F	-09	01	24	-19	-07	03	24	06	-47	-11	-23	-07	-02	08	00	-01	-07	41	-06	04	37	46											
Thoughtfulness	T	-07	-06	-15	-05	-01	06	25	00	16	33	13	-02	31	25	09	11	10	33	14	-04	-10	-18	-04										
Personal Relations	P	04	16	26	-17	03	02	06	-07	-43	-11	-07	-21	09	08	13	-23	-03	18	09	04	35	55	51	-04									
Masculinity	M	01	-03	34	13	20	-21	38	-26	-23	-10	17	-33	12	08	20	-24	06	08	22	22	42	57	29	-13	32								
% Heart Rate Increase	HRI	-12	-00	00	-15	22	13	11	03	-13	-10	-10	-08	07	00	11	04	-04	-09	07	-03	08	10	06	-07	06	10							
Heart Rate Decision Increase	HRDI	-10	06	-00	-12	24	14	16	-01	-15	-07	-06	-07	12	00	12	05	-02	-07	10	03	05	10	06	-05	07	11	95						
Number Correct	NC	00	25	12	15	04	-03	-05	20	-11	-10	06	-10	02	03	-13	-03	10	-24	-14	-09	06	04	02	04	14	01	00	01					
Total Time	TT	10	17	02	12	-15	-19	-07	15	-25	02	-17	-11	08	-06	-12	-02	-11	01	-22	-13	-04	-03	00	05	-02	-01	-27	-27	29				
Number Wrong	NW	-00	-26	-12	15	-03	03	04	-21	12	10	-05	10	-02	-02	13	04	-10	23	15	09	06	-05	-03	-05	-14	-01	00	-02	-99	-29			
P.E.S.	PES	16	-04	-01	-02	-05	-14	16	-02	-10	17	-05	-01	22	-01	07	-09	-07	17	08	08	08	10	03	12	-06	07	10	-06	-33	53	33		
G.S.R.	GSR	-16	04	05	13	19	-13	21	-15	-09	05	16	-08	15	-00	-04	-16	-15	06	11	11	04	05	03	-03	03	17	27	23	14	-13	14	-03	

a. Decimal points and plus signs are omitted.
b. Levels of significance based on 69 degrees of freedom: .01, r = .302; .05, r = .233; .10, r = .20



requirements of simple structure (Harman, 1960, p. 292). Kaiser (1958) suggests that varimax rotation has an "invariance property" which means that the factorial description of a test developed by varimax rotation remains invariant to a large extent while the test is moved to another battery containing the same factors.

The results of the varimax rotation are reported in Table III. Included also are the sums of squares and the percentages of total and common variance.

Analysis of Factor Loadings

The factor loadings above $\pm$ .30 have been selected for comparisons and interpretation. An attempt has been made to discover psychologically meaningful clusters from the variables entered into the factor matrix.

Interpretation of Factor Loadings

Factor I appears to be descriptive of a person concerned with public relations and was identified as a personal relations factor. High loadings appeared on the variables Friendliness (.853), Personal relations (.773), Objectivity (.723), Paranoid Schizothmia (-.605), Emotional stability (Guilford-Zimmerman .559) (Cattell .321) and Restraint (.372).

Factor II was identified as a sociability factor with high loadings on sociability (.853), Ascendance (.755), Surgency (.628), Cyclothymia (.602), Restraint (-.428), Sophistication (.412), General

Activity (.403), Autonomic resilience (.314).

Factor III was loaded most highly on Number correct (-.963), Intelligence (-.330), Restraint (.306) and General Activity (-.250). Students who scored high on this factor, tended to have high levels of accuracy, intelligence and activity.

Factor IV was identified as a physiological factor with high loadings on Heart-rate increase (.930), GSR (.375) and Surgency (.287).

Factor V was a further personality factor with high loadings on Will control (.851), Nervous tension (-.646), Emotional stability (.549) and (.540), Autonomic resilences (.309), and Objectivity (.306). Subjects scoring high on this factor tended to be emotionally stable and reported high levels of nervous tension. It was identified as a factor of emotional stability.

Factor VI was a further personality factor with high loadings on Thoughtfulness (.817), Hysteric Unconcern (.640), Restraint (.496), Radicalism (.398).

Factor VII was identified as a factor of emotional sensitivity and included high loadings on Emotional sensitivity (-.727), Cyclothymia (-.396), Autonomic Resilience (.386) and Masculinity (.367).

Factor VIII had high loadings on Anxious insecurity (-.526), Radicalism (.502), Dominance (.836), Emotional Stability (.371) and Independent self-sufficiency (.339). It was labelled a factor of dominance.

TABLE II

UNROTATED PRINCIPAL AXIS FACTOR MATRIX

Variable	Factor										h^2
	I	II	III	IV	V	VI	VII	VIII	IX	X	
Cyclothymia	056[a]	-319	329	-426	-090	-387	250	178	-197	-146	706
Intelligence	102	367	262	-021	315	-054	-132	-202	-240	-372	571
Emotional Stability	654	116	130	-117	054	018	-273	274	-012	191	662
Dominance	113	-452	054	024	423	-190	-130	480	390	064	839
Surgency	326	-563	293	048	169	-130	169	054	033	-028	589
Character Strength	-214	-210	-090	291	-307	279	469	159	-067	060	608
Autonomic Resilience	537	-184	-165	-046	017	167	191	-315	-122	291	614
Emotional Sensitivity	-278	060	385	-010	089	-337	415	362	-016	-129	671
Paranoid Schizothymia	-485	-417	-109	-129	-011	205	-093	084	-277	-099	581
Hysteric Unconcern	-135	-054	-274	-223	358	099	237	-193	-113	-372	529
Sophistication	077	-478	141	-188	120	391	-175	-189	278	027	601
Anxious Insecurity	-425	-098	-098	010	-393	100	-075	-254	-097	-036	445
Radicalism	231	029	-070	-112	649	-051	134	085	049	-055	526
Independent Self-Sufficiency	232	115	-210	-021	309	508	-128	147	232	-125	573
Will Control	462	096	-330	-010	189	129	-175	299	-522	163	803
Nervous Tension	-563	-089	-018	264	-098	103	273	023	420	123	682
General Activity	115	-394	218	-167	-209	471	070	105	048	215	574
Restraint	179	399	-623	024	055	167	311	215	023	-064	759
Ascendance	414	-656	003	-196	-011	088	160	018	-058	-163	705
Sociability	346	-613	210	-255	-230	-086	181	-198	-085	-128	760
Emotional Stability	711	094	-100	-047	-385	092	-004	058	-161	093	721
Objectivity	786	119	100	-074	-243	-030	018	-012	066	-171	742
Friendliness	462	405	-084	173	-333	-025	373	-003	297	-158	778
Thoughtfulness	-072	-041	-265	-195	411	487	485	-078	-065	-019	767
Personal Relations	556	324	121	102	-199	039	204	032	115	-372	674
Masculinity	692	-043	027	-028	-034	-008	-081	-104	263	101	580
% Heart Rate Increase	229	-197	052	810	204	-156	149	-065	-171	157	896
Heart Rate Decision Increase	247	-213	059	777	228	-123	191	-117	-199	148	893
Number Correct	-003	335	799	022	162	365	096	-066	-075	087	938
Total Time	-077	461	196	-470	179	-243	226	-206	097	406	837
Number Wrong	-003	-342	-799	-021	-162	-361	-108	072	084	-087	943
P.E.S.	115	047	-366	-454	136	-387	297	-235	025	349	790
G.S.R.	228	-211	-097	276	282	-166	-190	-488	205	-181	638
Sum of Squares	4.701	3.286	2.799	2.454	2.183	1.981	1.706	1.380	1.302	1.203	22.996
% Total Variance	14.24	9.93	8.48	7.42	6.60	6.00	5.15	4.18	3.93	3.63	69.56
% Common Variance	20.42	14.32	12.26	10.65	9.45	8.62	7.39	6.03	5.62	5.21	100

[a] all decimal points have been omitted

TABLE III

VARIMAX ROTATED FACTOR MATRIX

Variable	Factor										h^2
	I	II	III	IV	V	VI	VII	VIII	IX	X	
Cyclothymia	-049[a]	602	-005	-189	043	-081	-519	054	-058	147	706
Intelligence	087	-094	-330	009	110	143	-105	-052	-627	-076	571
Emotional Stability	321	075	-135	-066	549	-256	154	371	-038	042	662
Dominance	-166	207	175	063	-081	-113	-015	836	071	-104	839
Surgency	019	628	-049	287	-021	-034	-040	325	019	-032	589
Character Strength	-000	045	027	216	-155	185	-163	-243	612	-202	608
Autonomic Resilience	222	314	019	260	309	174	386	-083	134	313	614
Emotional Sensitivity	-036	050	-195	015	-251	003	-727	186	047	035	671
Paranoid Schizothymia	-605	161	118	-146	-017	161	-048	-179	147	-270	581
Hysteric Unconcern	-129	082	128	-083	-085	640	-030	-049	-247	014	529
Sophistication	-172	412	-141	-143	-152	059	533	181	081	-109	601
Anxious Insecurity	-242	-024	116	-115	-218	-085	072	-526	111	-104	445
Radicalism	011	016	-041	103	121	398	-014	502	-243	171	526
Independent Self-Sufficiency	153	-190	-073	-149	143	363	396	339	034	-247	573
Will Control	012	-104	112	126	851	145	050	116	008	-034	803
Nervous Tension	-168	-219	018	077	-646	029	-036	-006	423	-042	682
General Activity	-057	403	-250	-142	077	-024	248	018	494	-110	574
Restraint	372	-428	306	-038	226	496	-041	036	197	048	759
Ascendance	069	755	156	036	147	170	112	133	106	-113	705
Sociability	103	853	063	008	013	-046	034	-110	023	038	760
Emotional Stability	559	177	064	001	540	-142	150	-133	145	026	721
Objectivity	723	284	-026	-040	306	-125	106	042	-122	-017	742
Friendliness	853	-125	046	054	-075	042	-060	-073	113	040	778
Thoughtfulness	-105	019	-116	-012	006	817	115	046	210	122	767
Personal Relations	773	052	-120	004	081	061	-080	-017	-122	-166	674
Masculinity	498	241	018	066	179	-156	367	240	-051	135	580
%Heart Rate Increase	049	004	-002	930	036	-079	-015	091	023	-112	896
Heart Rate Decision Increase	049	050	-032	935	042	-018	005	064	012	-085	893
Number Correct	057	-034	-963	007	-035	-024	-048	003	-039	-017	938
Total Time	029	-171	-311	-242	-068	001	-135	038	-104	785	837
Number Wrong	-065	032	965	-012	030	018	055	004	042	008	943
P.E.S.	024	075	327	-080	071	178	-025	024	-028	795	790
G.S.R.	071	145	190	375	-220	018	405	095	-462	-011	638
Sum of Squares	3.307	3.108	2.602	2.334	2.332	1.979	1.920	1.911	1.772	1.731	22.996
% Total Variance	10.03	9.42	7.87	7.06	7.05	6.00	5.81	5.78	5.36	5.24	69.62
% Common Variance	14.29	13.86	11.30	10.15	10.14	8.61	8.35	8.30	7.69	7.52	100

[a] all decimal points have been omitted

Factor IX was identified as a factor of generalized anxiety and included high loadings on Nervous Tension (-.423), GSR (-.462), General Activity (.494), Character Strength (.612) and Intelligence (-.627).

Factor X had high loadings on total time (.785), Autonomic resilience (.313) and Paranoid Schizothymia (-.270). It was identified as a speed in decision making factor.

TEST OF HYPOTHESES

Hypothesis I

There are significant relationships between measures of personality, heart rate, GSR and information intake as measured by the number correct on Gibson's "feelee tasks."

(a) GSR and Number Correct

The relationship between GSR and number correct was computed by the use of both linear and curvilinear techniques. Product-moment correlations are summarized in Table I. The correlation between GSR and number correct using linear statistical analyses, was found to be .14 which is statistically insignificant.

Curvilinear relationships between GSR and number correct are summarized in Table IV. These relationships were found to be statistically insignificant.

TABLE IV

SUMMARY OF FINDINGS PERTAINING TO THE RELATIONSHIP BETWEEN PHYSIOLOGICAL VARIABLES AND NUMBER CORRECT

Physiological Variable	df (num/den)	F
GSR	1/67	0
Heart Rate	1/67	.4166*

*Sig. at .01 level.

TABLE V

SUMMARY OF PHYSIOLOGICAL CHANGES DURING ATTENTION TO INFORMATION INTAKE TASKS

Physiological Variable	Mean Change	S.D.	t
Heart Rate	17.69%	9.41	15.51*
GSR	29.33 ohms	130.11	1.88

*Sig. at .01 level.

The direction and amount of GSR change during attention to Gibson's "feelee tasks" is summarized in Table V. The amount of change from the period of rest to the period of "feelee" stimulation was found to be 29.33 ohms with a S.D. of 130.01. The amount of GSR change using the t test was found to be statistically insignificant.

(b) Heart Rate and Number Correct

The relationship between heart rate and number correct on Gibson's "feelee tasks" is reported in Tables I and IV.

The linear relationship as measured by the Product-moment correlation was found to be .00. The curvilinear relationship as measured by the Applied Multiple Linear Regression Analysis was found to be highly significant. The F ratio was .4166 with a probability of chance occurrence of .00001.

The direction and amount of heart rate change during attention to Gibson's feelee tasks is summarized in Table V. The amount of heart rate change from the period of rest to the period of attention to Gibson's "feelee tasks" was found to be 17.69% increase with a S.D. of 9.41. This increase of heart rate was statistically significant at or beyond the .01 level.

These findings do not support Lacy's hypothesis.

TABLE VI

CORRELATIONS BETWEEN SECOND-ORDER PERSONALITY SCORES, INFORMATION INTAKE SCORES AND PHYSIOLOGICAL MEASURES

Variable	Code	Ext	Anx	HRI	TT	NC	GSR
Extraversion	Ext						
Anxiety	Anx	-.034					
Heart Rate	HRI	.263	**-.087				
Total Time	TT	.143	-.050	-.279**			
Number Correct	NC	-.320	*-.063	-.002	.247**		
Skin Response	GSR	.244	**-.176	.247**	.145	.162	

*Sig. at .01 level

**Sig. at .05 level

(c) Personality Factors and Number Correct

The relationship between personality factors and the number correct on Gibson's "feelee tasks" are presented in Tables I and III. Table VI summarizes the relationship between second-order personality factor scores and number correct.

The following personality factors correlated significantly with number correct:

B - Intelligence (.2591)

R - Restraint (-.2399(

Ext - Extraversion (-.320)

By use of the varimax rotation technique it was found that factor III yielded high loadings on number correct (-.963),

intelligence (-.330) and restraint (.306).

Thus we might say that there was some support for the hypothesis that information intake is related to several personality factors and heart rate change but not to GSR. Although heart rate changed significantly, it was not in hypothesized direction.

Hypothesis II

There are significant relationships between measures of personality, heart rate, GSR and information intake as measured by the total time required to reach a decision on Gibson's "feelee tasks."

(a) GSR and Total Time

The correlation between GSR and total time required to reach a decision is summarized in Table I. The Pearson-Product moment correlation was found to be insignificant.

(b) Heart Rate and Total Time

Table I shows the relationship between heart rate and total time. The correlation was .27 and was significant at or beyond the .05 level.

(c) Personality Factors and Total Time

The correlation between measures of personality and total time are summarized in Tables I, II, and VI. The following personality factors correlated at or beyond the .05 level:

L - Paranoid Schizothymia (-.255)

A - Ascendance (-.228)

As shown on Table III, Factor X yielded high loadings on total time (.785), Autonomic resilience (.313) and Paranoid schizothymia (-.270).

TABLE VII

MEANS AND STANDARD DEVIATIONS

Variable	Mean	S.D.
Cyclothymia	8.2676	1.8228
Intelligence	5.1127	1.2621
Emotional Stability	7.1549	2.2244
Dominance	5.5493	2.2379
Surgency	7.3944	2.7806
Character Strength	5.1972	2.2368
Autonomic Resilience	7.4225	2.2869
Emotional Sensitivity	4.9859	2.2859
Paranoid Schizothymia	4.7887	1.7992
Hysteric Unconcern	6.1408	2.1708
Sophistication	5.6620	1.8610
Anxious Insevrity	4.3803	2.0785
Radicalism	6.3239	2.2566
Independent Self-Sufficiency	8.0141	1.8951
Will Control	6.3521	2.4786
Nervous Tension	5.3944	2.7552
General Activity	15.2676	5.6443
Restraint	16,9155	4.8781
Ascendance	15,3803	5.3322
Sociability	18,7746	6.8899
Emotional Stability	17,4366	6.2342
Objectivity	17,2958	5.3935
Friendliness	14,2676	5.6193
Thoughtfulness	18,5352	4.8523
Personal Relations	17,4648	5.5610
Masculinity	18,6197	4.3520
% Heart Rate Increase	17,6901	9.4072
Heart Rate Decision Increase	21,6761	10.0922
Number Correct	4.0704	1.6558
Total Time	240.6479	121.9115
Number Wrong	2.9437	1.6435
P.E.S.	62.7539	38.5447
G.S.R.	29.3366	130.1100
Extraversion	7.227	2.1611
Anxiety	4.102	2.0908

CHAPTER IV

SUMMARY AND DISCUSSION

This study offered some confirmation that there are significant relationships between GSR, heart rate, personality factors and information intake scores. Earlier studies have demonstrated similar relationships. A group of studies have investigated the cognitive control factors, scanning and articulation, and have related these to subgroups within schizophrenia and several personality factors. Other studies have explored the role of underlying physiological correlates of information intake.

Silverman (1964) has developed the notion that the cognitive control principles, scanning and articulation may be useful diagnostic categories in differentiating subgroups within schizophrenia. He has reviewed research studies which demonstrate that both extreme and limited forms of scanning and articulation seem to characterize the perceptual response dispositions of various forms of schizophrenia. Other studies (Block, 1957; Ardis and Fraser, 1957; Thouless, 1932) have related the personality factors extraversion-introversion to perceptual response dispositions and have found low but significant correlations. Jackson (1957) found a significant relationship between intelligence and field-dependence-independence. Gardner, et al (1959) report studies which indicate that limited articulation is associated with various personality characteristics such as ego weakness,

dependency and intense orientation toward other people. From these and other studies reviewed earlier, it was inferred that information intake may also be significantly related to various personality factors.

Lacey's experimental and theoretical studies were included to provide further insights into the physiological correlates of information intake. Lacey hypothesized that cardiovascular activity may be instrumental in helping the organism either to enhance or reject environmental input.

Hypothesis I of the present study received considerable confirmation. Although heart rate did not decrease as hypothesized, cardiovascular activity did correlate significantly with the number correct on Gibson's "feelee tasks." These findings lend considerable support to the studies of Malmo and associates (1959). Their findings have demonstrated that the relationship of level of performance to activation can best be described by an inverted U shaped curve. That is, up to a point, which differs according to the nature of the performance measure, level of performance increases with increasing activation, but beyond that point, performance level declines. In the present study, the optimum level of heart rate increase in the Gibson "feelee task" situation appeared to be 15 to 25% (See Figure V in appendix B).

Presumably, the reason for the lack of support in this study of Lacey's hypothesis, lies with the nature of the stimulus used. The results of this study suggest that Gibson's "feelee tasks" provide

stimulation which is qualitatively different from stimulation received from such stimuli as pictures, drama and light flashes. Gibson's "feelee tasks" tend to produce stimulation similiar to that produced by cognitive tasks such as spelling and arithmetic.

Several other factors besides heart rate correlated significantly with the number correct on Gibson's feelee tasks. These included intelligence, restraint and extraversion. Presumably, intelligence could be expected to be related to the number correct. Further studies need to be undertaken to determine to what extent information intake as measured by this experiment, is a general intellectual ability or a specific ability entering only into those behaviors which require optical and tactile matching of relatively identical elements.

Turning now to personality factors, the second-order personality factor extraversion was negatively correlated with the number correct. Thus it would appear, contrary to Cattell's hypothesis, that the introvert is more aware of external stimulation than the extravert. The reason for this contradictory finding may be that Cattell's hypothesis has been too broadly applied in this study. Extravert preference for external sources of stimulation and introvert preference for internal sources of stimulation may apply to only certain types of situations. The most likely situation where such preference might be demonstrated would be in a social and interpersonal

situation and not in a stimulus situation free from social implications. Certainly, Cattell's personality descriptions characterize the subjects' social orientation more than his non-social or object perception. Whereas Gardner's team of researchers has been largely concerned with non-social perceptual tasks, Cattell's scale is generally socially oriented. Perhaps characteristic response dispositions which apply in social situations, do not apply in situations which require accurate object discriminations. In any case, the contradictory findings of this study would suggest that social stimulation is different than object stimulation and that the introvert is more accurate in object perception than the extravert.

A further personality factor significantly related to accuracy was "restraint." This finding would suggest that personality functioning associated with deliberation, persistent effort and self-control may produce a condition which is manifested by a decrease in exploratory activity and consequent decreased exteroceptive input.

A second hypothesis which related GSR, heart rate, personality factors and total time required to reach a decision similarily received some confirmation. Although GSR did not correlate significantly with total time, it was interesting to note that GSR correlated with restraint-timidity and extraversion-introversion at or beyond the .05 level of significance.

Earlier studies (Cattell, 1955) have reported significant

relationships with restraint-timidity but not with extraversion. Eysenck (1957) reported opposite findings in which GSR correlated significantly with introversion. He found that introversion was associated with depression and sympathetic excitation and extraversion with a more quiescent physiological state.

A plausible reason for the difference in findings in the present study from Eysenck's earlier investigation may result from underlying differences in theory. Cattell (1955) stresses the role of learning and experience in the development of extraverted and introverted personalities. According to Cattell, introverts develop introverted behavior patterns from frustrations in reacting outwardly and attending to external stimuli. Such frustrating and painful experiences repeated over and over condition the introvert to prefer attending to internal, subjective ideas, images, memories and fantasies. At length, his behavior and perceptions are guided predominantly by internal stimuli as opposed to external stimuli.

In contrast to Cattell's explanations, Eysenck's (1957) theory of extraversion-introversion minimizes the role of learning and experience and emphasizes the importance of constitutional factors. Eysenck hypothesizes differences in cortical excitation, and inhibition in extraverts and introverts. Introverts are characterized by cortical excitation, slowness in developing reactive inhibition, weak reactive inhibition and quick dissipation of reactive inhibition. Extraverts

display opposite tendencies. Presumably these constitutional differences and resulting cortical processes dispose the introvert to develope physiological responses.

Returning to a discussion of the relationship between personality factors and information intake, it was found in the present study that paranoid schizothymia and ascendance correlated negatively but significantly with total time required to verbalize a decision. Subjects who took a long time to verbalize a decision tended to be described as free of jealous tendencies, composed, trustful and adaptable. It could be hypothesized that this group of subjects enjoyed the experience of matching the "feelees."

The second personality factor which correlated significantly with total time was submission. People associated with this factor tended to be shy, bashful and suspicious. A plausible explanation for this group's slowness in reaching a decision may be related to the suspicious manner in which the tasks were reviewed. In an earlier study (Gardner, et al, 1959) slowness of reaching a decision was associated with extensive scanning. It would appear reasonable to hypothesize the existence of a close relationship between suspicious personality functioning and extensive scanning. It might be expected that the suspicious person would scan the environment extensively in search of cues before reaching a decision. However before such a relationship can be assumed with a degree of assurance, further

experimental studies relating scanning and suspiciousness need to be undertaken.

CHAPTER V

CONCLUSIONS

The conclusions that appear warranted by this study are:

(1) Number correct on Gibson's "feelee tasks" is significantly correlated with the factors intelligence, restraint, extraversion and heart rate.

(2) Total time required to verbalize a decision is significantly correlated with paranoid schizothymia and ascendance.

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A P P E N D I X "A"

KEY TO COLUMN HEADINGS FOR RAW DATA

IDENTIFICATION SYMBOLS		DESCRIPTION	
I.D.		Identification Data	
Sixteen Personality Factor Questionnaire			
Factor A	Warm, social	Versus	Aloof, stiff
Factor B	General Intelligence	Versus	Mental Defect
Factor C	Emotional Stability	Versus	Dissatisfied Emotionality
Factor E	Dominance	Versus	Submission
Factor F	Surgency	Versus	Desurgency
Factor G	Super Ego Strength	Versus	Lack of Rigid Internal Standards
Factor H	Adventurous	Versus	Shy, timid
Factor I	Sensitive, Effeminate	Versus	Tough, Realistic
Factor L	Suspecting, jealous	Versus	Relaxed, adaptable
Factor M	Bohemian Introverted	Versus	Practical, Concerned with facts
Factor N	Sophisticated, Polished	Versus	Simple, unpretentious
Factor O	Timid, Insecure	Versus	Confident, Self-serve
Factor Q_1	Radicalism	Versus	Conservatism of temperament
Factor Q_2	Self-Sufficiency	Versus	Group Dependency
Factor Q_3	High Self-sentiment	Versus	Poor self-sentiment
Factor Q_4	Tense, Excitable	Versus	Phlegmatic, Composed
Guilford Zimmerman Termperament Survey			
Factor G	General Activity Energy	Versus	Inactivity, Slowness
Factor R	Restraint, Seriousness	Versus	Impulsiveness, Rhathymia
Factor A	Ascendance, Social Boldness	Versus	Submissiveness
Factor S	Social Interest, Sociability	Versus	Shyness, Seclusiveness
Factor E	Emotional Stability	Versus	Emotional Instability, Depression
Factor O	Objectivity	Versus	Subjectivity, Hypersensitiveness
Factor F	Friendliness, Agreeableness	Versus	Hostility, Belligerence
Factor T	Thoughtfulness, Reflectiveness	Versus	Unreflectiveness
Factor P	Personal Relations, Cooperativeness	Versus	Criticalness, Intolerance
Factor M	Masculinity, Feminity	Versus	Feminity, Masculinity

KEY TO COLUMN HEADINGS FOR RAW DATA (continued)

Physiological Measurements

H.I.	Percent Heart-Rate Increase during task
H.D.	Percent Heart-Rate Increase during decision
G.S.R.	Galvanic Skin Response during task

Perceptual Information Scores

N.C.	Number Correct
N.W.	Number Wrong
T.T.	Total Time
P.E.S.	Perceptual Efficiency Score

Second-Order Factors

Ext	Extraversion-introversion
Anx.	Anxiety

RAW DATA

I.D.	A	B	C	E	F	G	H	I	L	M	N	O	Q_1
1	8	7	7	6	4	2	10	7	5	4	4	3	6
2	5	6	7	2	5	3	6	3	7	8	4	9	6
3	8	7	6	4	7	6	8	7	4	11	6	8	5
4	7	4	7	5	9	5	7	7	4	7	2	3	9
5	6	5	7	8	11	4	11	2	4	8	7	4	10
6	8	6	8	8	12	4	7	8	4	6	6	5	11
7	10	6	9	5	11	9	9	6	8	4	6	2	6
8	6	7	6	2	4	7	8	4	4	6	5	2	7
9	7	7	8	3	5	5	9	3	4	6	5	4	6
10	11	4	7	8	10	6	6	6	5	8	0	2	6
11	7	4	7	7	11	5	3	3	7	6	8	5	5
12	9	5	5	3	5	3	4	5	5	5	3	7	1
13	8	5	10	6	9	8	7	7	4	5	6	3	3
14	10	5	10	5	8	3	10	8	4	8	8	2	4
15	8	5	9	5	7	6	10	5	4	6	4	6	11
16	9	6	7	2	9	4	8	7	4	7	5	3	8
17	10	7	9	7	10	7	7	0	4	8	7	5	7
18	7	7	8	2	8	4	9	2	2	2	6	8	5
19	9	4	6	6	9	2	6	4	5	7	8	4	5
20	8	6	8	8	12	4	8	6	5	2	8	2	11
21	7	5	9	5	5	7	7	3	6	2	5	3	7
22	10	4	6	5	9	3	8	8	5	7	4	6	5
23	9	5	9	8	8	4	7	3	3	8	7	2	8
24	10	6	7	4	11	6	12	4	1	10	4	2	5
25	12	5	8	10	3	2	4	10	7	5	6	6	9
26	11	6	10	8	9	3	8	4	1	5	6	4	9
27	6	2	1	4	9	10	7	4	4	6	6	6	4
28	10	5	4	8	9	10	5	8	7	6	7	2	2
29	12	7	8	6	9	7	9	6	4	6	2	5	6
30	6	7	6	9	11	2	5	3	3	8	7	2	5
31	8	4	10	4	4	7	4	4	3	4	5	5	7
32	8	5	7	5	7	7	6	9	7	6	5	7	6
33	8	5	7	6	3	6	2	8	5	4	4	9	6
34	6	6	10	7	9	4	10	3	3	4	8	2	5
35	5	5	10	5	2	2	6	1	4	6	5	5	7
36	7	6	6	6	6	4	8	3	8	9	4	5	8

I.D.	A	B	C	E	F	G	H	I	L	M	N	O	Q1
37	6	2	1	4	9	10	7	4	4	6	6	6	4
38	8	2	7	4	4	4	8	9	5	8	4	2	7
39	8	4	8	8	4	6	10	8	4	6	3	2	7
40	12	5	6	6	8	2	6	6	4	8	8	2	10
41	10	3	8	2	6	6	10	1	7	2	8	4	6
42	10	5	4	8	9	10	5	8	7	6	7	5	5
43	9	3	8	9	10	7	9	3	5	8	6	3	9
44	7	4	9	8	7	8	8	7	5	7	5	2	8
45	8	4	5	8	6	8	8	6	6	9	9	7	5
46	9	5	9	6	8	6	8	4	4	5	5	6	6
47	10	4	7	9	12	2	6	4	6	4	10	7	6
48	11	6	9	5	8	5	5	5	1	6	4	3	9
49	9	4	7	7	9	4	7	6	6	5	6	2	8
50	6	4	8	6	9	5	10	5	4	0	5	4	3
51	9	5	9	7	9	3	9	4	2	3	2	2	4
52	8	6	8	3	9	2	8	5	4	6	7	4	4
53	8	6	8	8	12	4	8	6	5	2	8	2	11
54	10	6	4	0	8	4	6	6	4	6	6	6	8
55	8	4	8	4	6	2	12	2	4	8	8	4	10
56	6	4	6	2	2	10	8	2	4	6	6	6	6
57	10	6	2	5	8	6	2	10	4	5	6	5	6
58	8	6	6	7	4	5	6	3	7	10	6	1	8
59	5	8	3	4	1	5	6	4	4	7	6	2	8
60	8	6	4	2	2	6	5	8	7	7	6	8	6
61	8	5	3	4	3	4	3	2	8	4	2	8	5
62	9	5	6	5	11	8	10	6	7	7	6	4	6
63	6	4	10	8	8	6	8	4	3	4	6	7	5
64	10	4	8	6	6	8	12	2	9	8	10	6	6
65	9	5	12	2	9	5	7	7	3	6	5	5	5
66	8	5	5	4	9	7	9	4	9	10	6	7	6
67	10	6	8	6	8	2	7	6	8	8	6	5	4
68	3	7	8	5	5	4	5	3	4	8	4	1	4
69	10	3	7	3	3	5	12	2	5	5	6	6	0
70	6	4	12	10	6	4	10	6	3	6	6	4	6
71	9	3	6	7	7	5	6	5	4	10	5	5	7

RAW DATA

I.D.	Q_2	Q_3	Q_4	G	R	A	S	E	O	F	T	P	M
1	8	9	7	7	16	11	14	21	20	18	19	17	20
2	11	6	8	7	20	19	1	18	11	11	25	12	10
3	11	2	9	16	12	15	28	8	12	14	23	16	10
4	10	7	6	14	13	12	12	19	23	13	20	26	20
5	7	4	2	7	14	19	24	11	15	16	20	16	21
6	10	8	4	16	23	21	27	27	24	23	22	25	20
7	8	11	2	26	24	28	30	22	22	17	29	21	23
8	10	4	5	17	22	6	16	22	21	19	26	21	15
9	9	9	2	14	13	10	8	24	24	9	19	22	20
10	6	10	6	7	15	19	18	15	10	10	18	18	13
11	9	6	7	16	14	16	14	14	9	10	14	18	20
12	8	2	8	13	9	13	10	16	21	18	12	17	19
13	5	2	6	10	20	20	23	27	24	22	14	21	15
14	6	5	2	11	13	15	18	16	21	12	19	17	22
15	8	10	3	12	19	11	18	18	9	9	23	12	20
16	6	9	1	15	21	21	28	24	20	17	19	14	20
17	9	7	0	26	9	26	27	28	21	3	16	17	18
18	6	6	4	14	10	10	25	24	19	21	13	27	24
19	7	9	5	10	16	16	24	15	14	5	20	13	22
20	6	5	9	16	10	22	28	10	15	5	19	16	20
21	7	8	6	12	14	16	18	21	23	17	12	21	22
22	6	7	4	18	21	23	26	23	21	14	22	20	23
23	9	7	3	8	18	19	20	8	20	23	10	25	21
24	8	6	4	11	23	16	18	21	22	24	24	27	22
25	6	3	4	10	10	8	8	9	12	10	22	11	15
26	11	8	4	13	21	19	17	25	28	25	18	27	25
27	7	3	11	19	25	14	12	23	16	26	22	14	20
28	6	0	12	16	6	20	27	13	19	6	8	16	21
29	8	6	7	8	20	14	27	20	18	23	10	23	20
30	11	6	2	24	13	18	22	16	15	8	17	17	21
31	8	7	1	26	19	10	6	20	21	13	9	19	20
32	8	6	8	7	15	19	18	15	13	10	18	18	13
33	10	5	12	16	21	7	8	6	10	11	23	19	13
34	9	9	4	22	16	22	25	26	28	15	11	29	28
35	11	8	3	10	27	11	5	22	20	15	13	21	25
36	9	9	3	10	21	18	23	16	19	8	21	11	16

I.D.	Q_2	Q_3	Q_4	G	R	A	S	E	O	F	T	P	M
37	7	3	11	19	18	11	14	12	9	14	22	15	19
38	6	7	6	11	19	7	14	15	21	22	12	15	24
39	6	5	7	16	16	6	15	12	15	16	14	12	15
40	12	2	5	11	22	19	19	17	23	14	26	17	19
41	8	10	3	16	22	13	21	27	20	15	21	21	20
42	6	7	6	19	21	16	16	8	10	12	18	21	15
43	11	9	0	17	18	20	21	25	22	7	18	8	22
44	10	4	7	17	23	11	14	17	15	22	25	20	24
45	9	8	9	22	19	16	20	9	13	8	24	9	17
46	9	8	4	16	15	16	22	11	18	16	10	11	19
47	8	3	6	23	9	20	28	14	21	10	17	16	20
48	6	7	2	13	20	16	23	25	24	20	18	28	23
49	9	8	3	16	11	23	23	17	27	13	23	27	18
50	9	9	6	15	22	18	21	26	17	16	14	10	16
51	8	4	6	19	14	20	25	22	19	16	17	14	25
52	8	10	4	9	15	6	13	18	18	14	13	10	23
53	6	5	9	13	14	9	11	10	7	9	19	14	20
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55	6	8	8	19	21	22	18	21	23	15	26	19	23
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57	6	5	3	13	13	8	7	9	8	5	12	10	2
58	10	9	10	25	18	13	11	4	7	8	27	9	12
59	11	8	4	8	26	9	9	11	16	18	23	24	19
60	6	5	7	20	13	12	24	23	24	18	16	16	19
61	6	2	8	9	18	15	24	14	11	12	12	11	13
62	7	7	6	17	17	22	21	15	7	7	24	12	13
63	8	6	7	21	14	11	25	18	12	16	19	7	13
64	12	6	8	29	10	23	27	27	19	11	21	14	22
65	8	10	3	26	18	11	22	29	22	25	15	29	13
66	6	6	5	10	21	18	23	10	11	13	23	11	20
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68	5	7	2	17	14	17	23	14	14	13	19	20	16
69	8	9	7	7	26	4	3	17	13	12	20	17	16
70	12	8	6	21	17	24	20	22	22	27	22	18	20
71	5	7	4	13	18	15	17	18	15	12	18	19	18

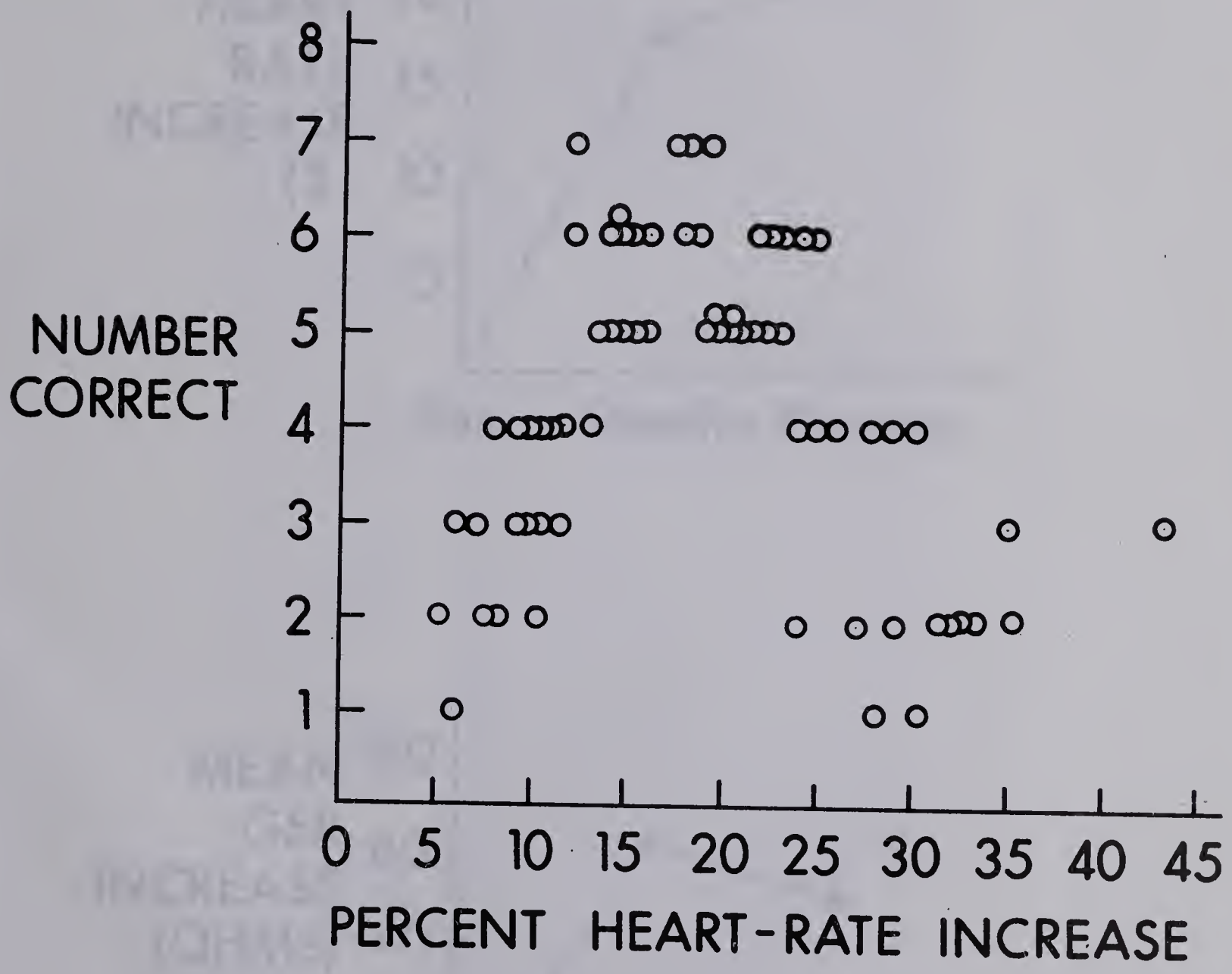
I.D.	H.I.	H.D.	N.C.	T.T.	N.W.	P.E.S.	G.S.R.	Ext.	Anx.
1	19	24	7	572	0	81.71	0	7.34	3.49
2	22	28	5	110	2	22.00	.6	3.42	7.13
3	12	22	6	532	1	88.26	.9	6.37	7.30
4	18	20	6	166	1	27.66	.3	6.99	3.70
5	35	37	2	118	5	59.00	1015.	11.07	1.93
6	33	35	2	200	5	100.00	45.0	9.86	3.29
7	19	27	5	165	2	33.00	.9	9.64	1.13
8	19	23	7	335	0	47.85	1.2	4.30	3.78
9	30	39	5	179	2	35.80	1.3	5.81	1.69
10	43	43	3	108	4	36.	2.4	9.27	3.25
11	15	16	6	228	2	38.	1.9	6.73	5.26
12	20	20	5	378	2	75.60	.5	3.95	7.89
13	12	15	7	182	0	26.00	.7	8.23	4.29
14	20	16	5	393	2	78.60	.2	9.21	1.36
15	8	12	4	479	3	119.75	1.5	8.14	2.48
16	2	5	3	410	4	136.66	.8	7.50	1.36
17	24	27	4	153	3	38.25	5.2	8.77	1.59
18	24	33	6	170	1	28.33	.4	7.23	3.87
19	9	15	3	188	4	62.66	6.0	7.70	3.89
20	23	30	6	264	1	44.	.3	10.54	4.91
21	32	35	2	115	5	57.50	2	5.77	3.65
22	4	8	3	97	4	24.25	1.2	8.66	4.37
23	3	13	3	188	4	62.66	.7	8.11	1.84
24	22	29	5	249	2	49.80	22.3	10.75	1.55
25	9	11	4	270	3	67.50	.4	6.27	5.67
26	33	36	2	159	5	79.50	.1	9.02	1.89
27	27	33	2	172	5	86.	.8	6.91	8.51
28	20	25	5	256	2	51.20	1.4	8.21	8.64
29	8	15	2	218	5	109.	1.4	9.46	4.49
30	20	26	5	208	2	41.	.6	7.88	1.82
31	22	28	6	369	1	61.50	.5	3.70	2.31
32	35	42	3	73	4	24.33	85	6.22	5.93
33	14	14	6	413	1	68.33	1.0	2.67	8.29
34	30	34	4	188	3	47.	406	9.12	1.05
35	3	2	3	199	4	66.33	3.9	3.18	2.72
36	28	38	1	240	6	240.	2.8	6.77	2.94

I.D.	H.I.	H.D.	N.C.	T.T.	N.W.	P.E.S.	G.S.R.	Ext.	Anx.
37	29	31	2	106	5	.53	.5	7.01	8.51
38	25	26	4	173	3	43.25	6.0	5.94	3.55
39	28	35	4	149	3	37.25	1.	8.22	3.62
40	10	14	3	302	4	100.16	12.7	7.00	4.50
41	16	20	5	231	2	46.20	.8	7.08	2.27
42	6	12	3	114	4	38.	2.7	8.21	5.88
43	14	19	5	240	2	48.	1.6	9.90	0.82
44	20	21	5	426	2	85.20	.5	7.68	4.11
45	30	36	1	62	6	62.	7.5	7.60	6.54
46	25	33	4	184	3	46.	.9	7.93	3.24
47	14	18	5	152	2	38.	1.6	9.93	6.38
48	20	28	5	413	2	82.60	.3	6.98	1.72
49	13	13	4	191	3	47.95	14.3	8.19	2.57
50	32	34	2	101	5	50.50	11.	8.79	3.04
51	11	12	4	572	3	143.00	1.7	9.31	3.05
52	18	21	6	279	1	46.50	20.	7.34	2.42
53	23	30	6	264	1	44.	15.	10.54	4.91
54	18	26	7	276	0	39.42	.7	5.64	5.68
55	5	15	2	393	5	196.50	.5	8.68	3.66
56	2	5	3	194	4	64.66	.2	3.80	5.34
57	10	10	4	458	3	114.50	.7	5.37	5.44
58	11	15	4	165	3	41.25	.7	5.33	5.27
59	15	18	6	176	1	29.33	3.6	2.44	3.46
60	16	18	5	206	2	41.2	.5	3.02	7.56
61	3	5	0	250	7	25.0	1.2	3.13	9.25
62	14	17	5	220	2	44.0	3.0	10.11	4.35
63	11	14	3	118	4	29.33	.3	8.24	4.71
64	8	10	2	176	5	88.	.2	8.72	5.61
65	11	12	4	165	3	64.66	2.0	6.70	1.60
66	15	18	6	176	1	41.25	3.0	8.47	5.82
67	7	9	3	112	4	37.33	29.	7.84	4.85
68	10	12	3	253	4	84.33	.35	4.39	3.37
69	6	8	1	393	6	393.	5.0	2.82	2.55
70	15	18	6	176	1	29.33	3.0	8.32	2.33
71	28	30	4	476	3	119.	.7	7.71	4.02

A P P E N D I X "B"

FIGURE V

THE RELATIONSHIP BETWEEN HEART-RATE INCREASE AND PERFORMANCE



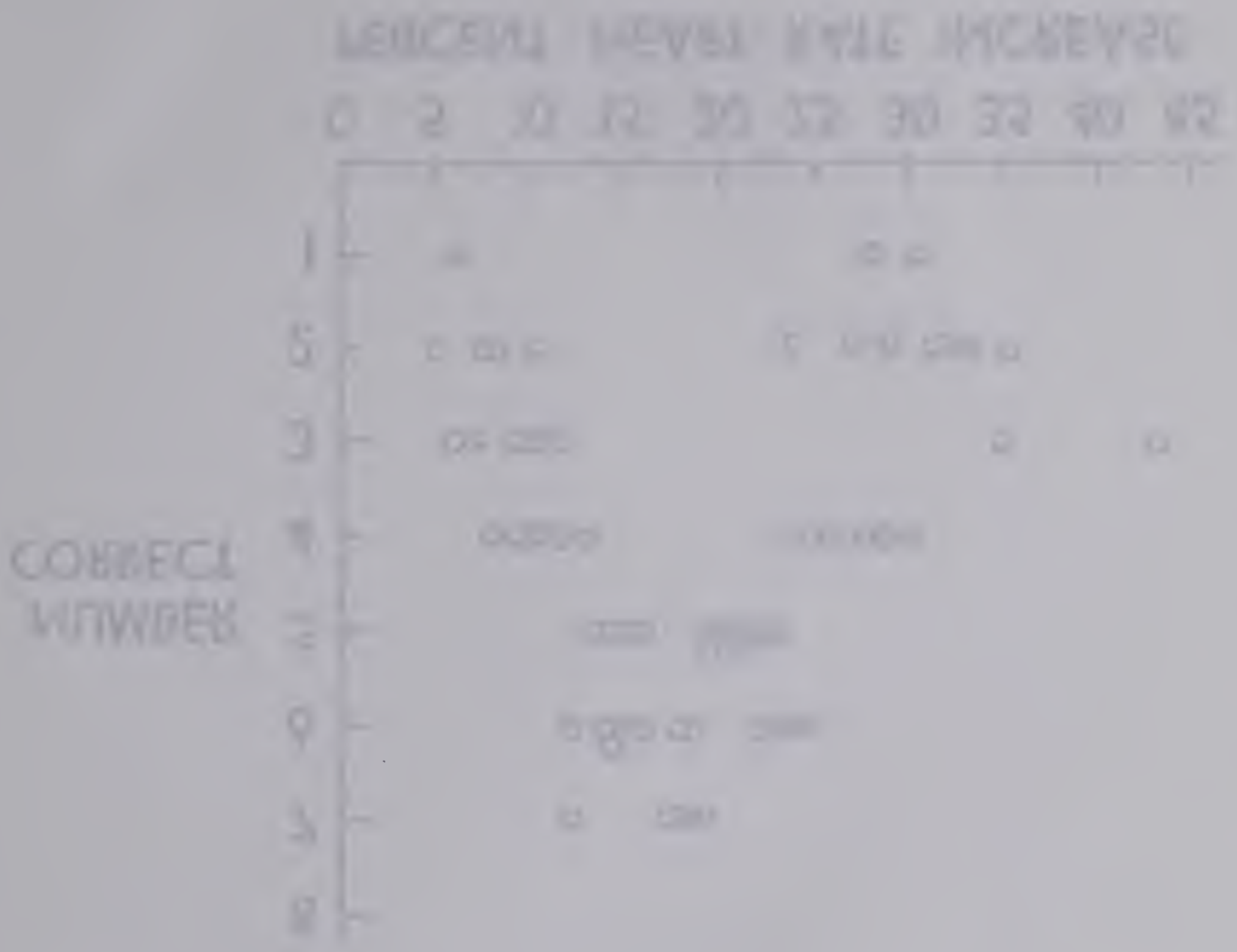
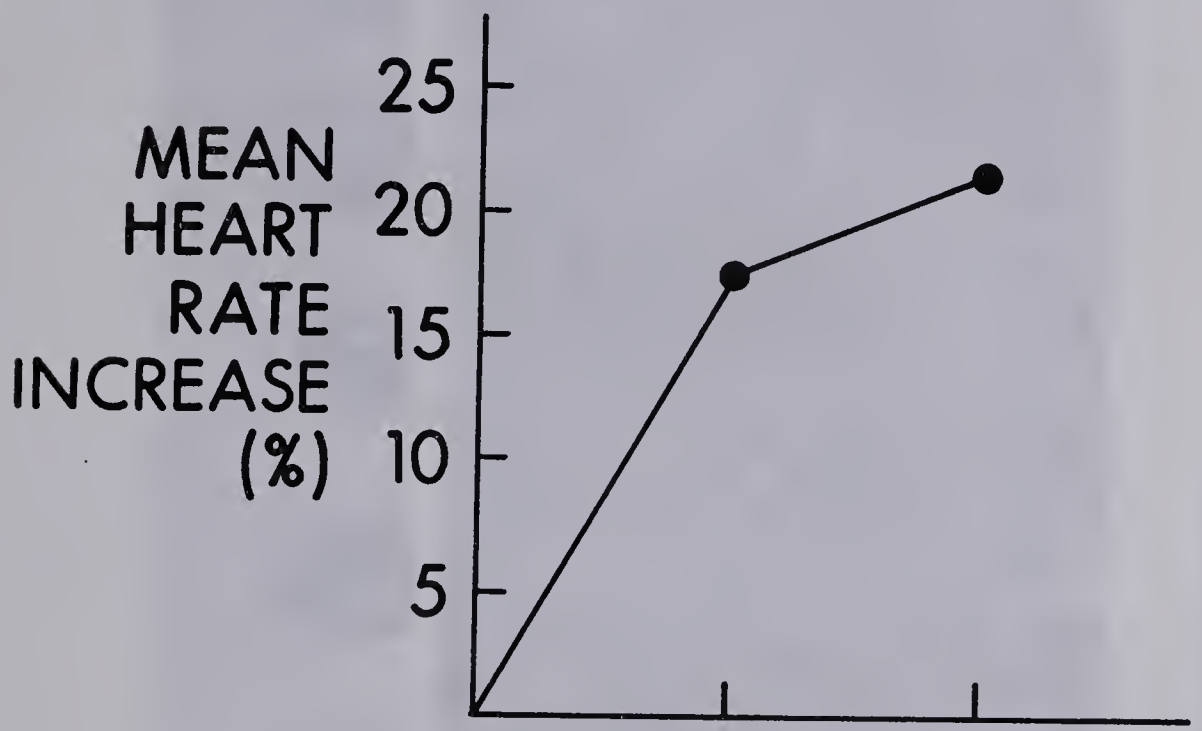
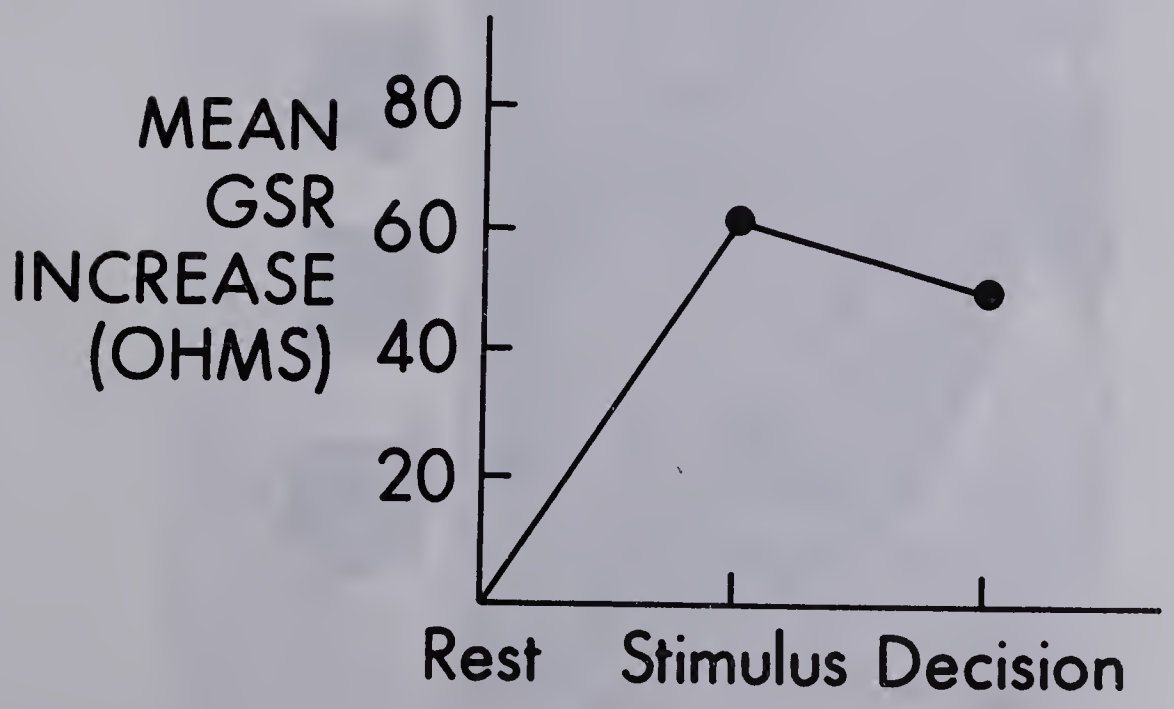

CORRECT

FIGURE VI

PHYSIOLOGICAL RESPONSIVENESS DURING REST, STIMULUS PRESENTATION AND DECISION MAKING



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30
20
10
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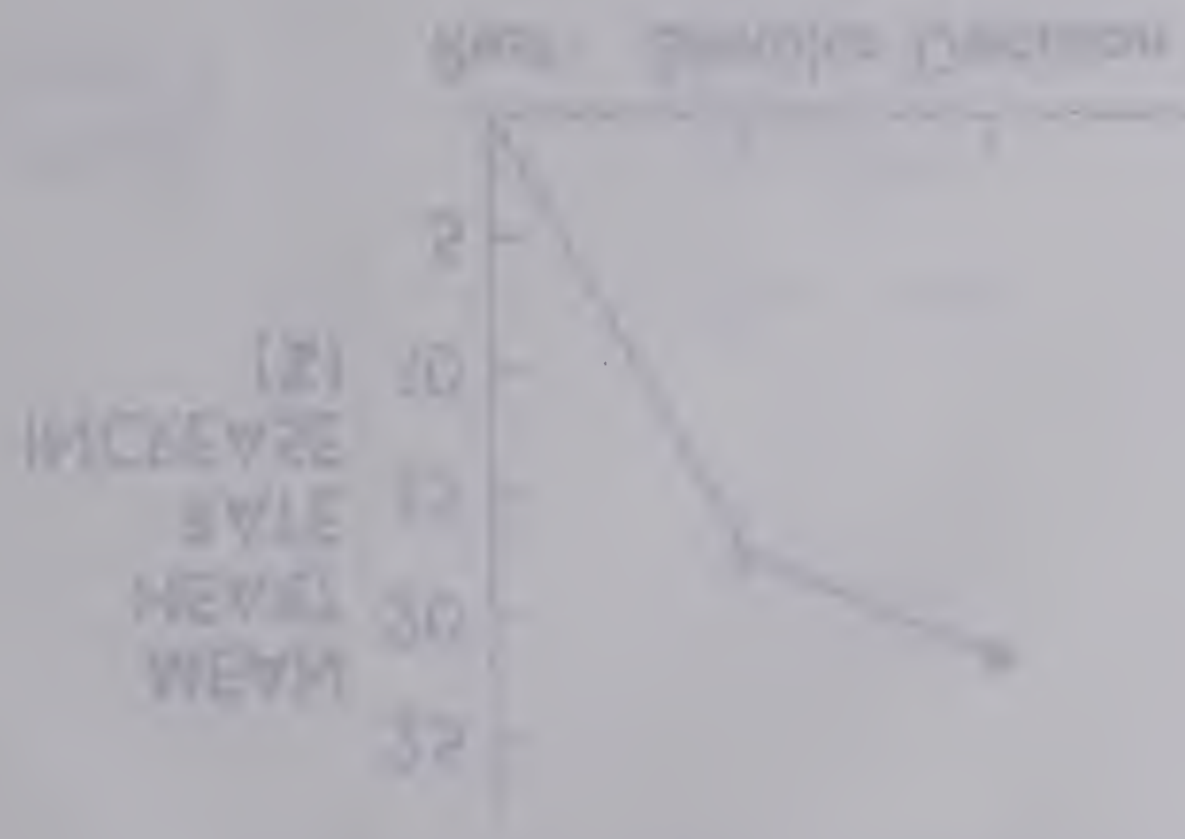
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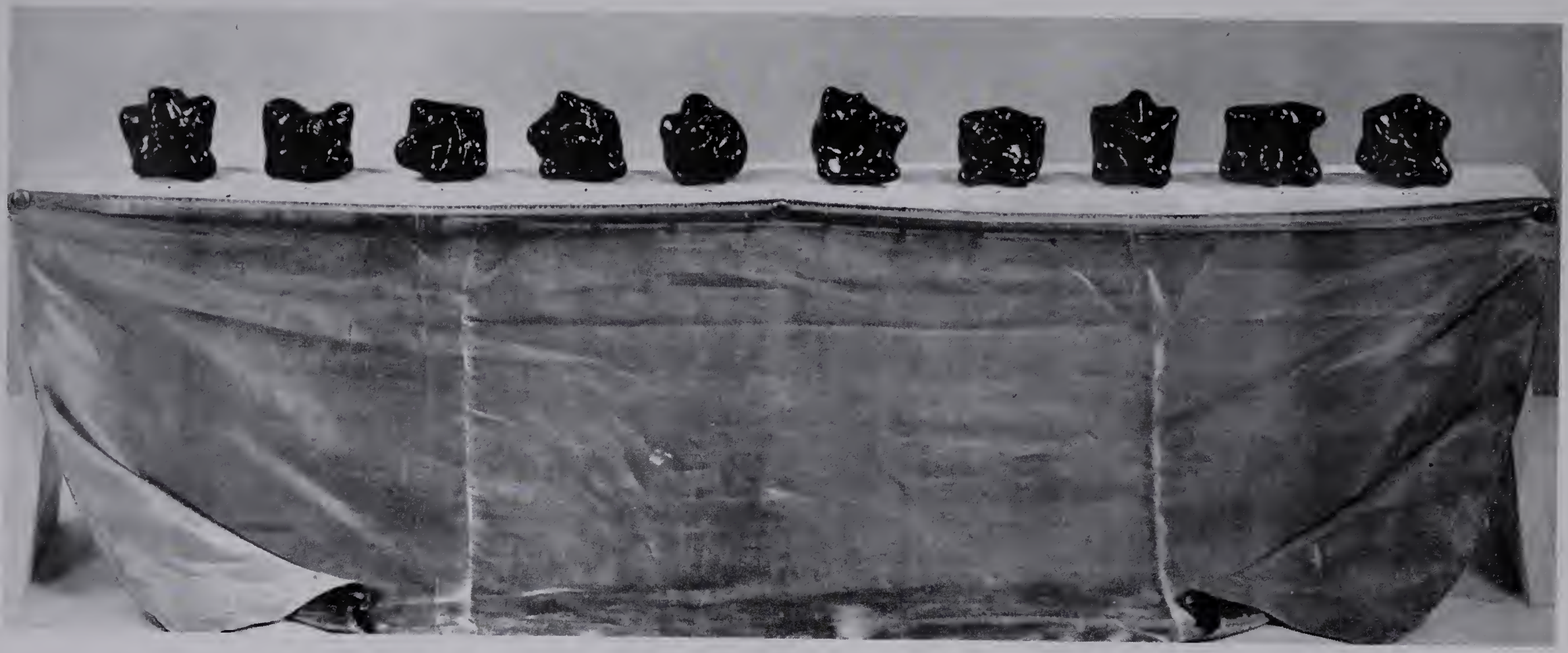

Gibson "Feelee Tasks"